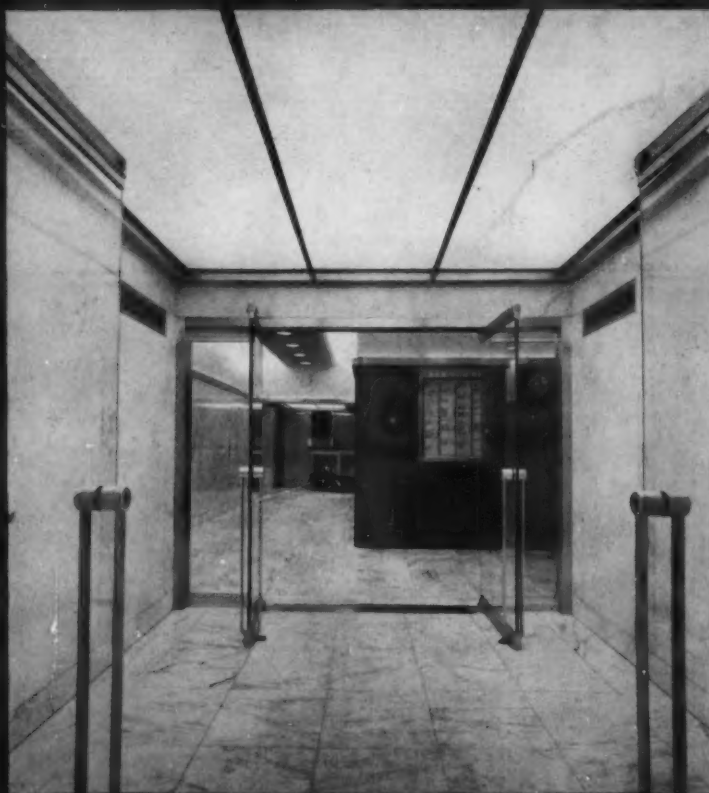


# ELECTRICAL CONSTRUCTION AND MAINTENANCE

\$1,000,000,000 BY 1965

SPECIAL REPORT

## WHAT'S AHEAD FOR LIGHTING



0.8

0.6

0.4

0.2

10 YEAR PROJECTION





**one plant...**

**one product...**



**the best...**

**Friction, Rubber Splicing  
and Plastic Electrical Tapes \***

**ACCURATE**

MANUFACTURING COMPANY  
GARFIELD, NEW JERSEY



OUR NEW CATALOG #47 WILL BE SENT ON REQUEST.



# How to build a more profitable chime business...

Select a line that doesn't put you in competition with your next door neighbor.

Edwards Door Chimes are sold only by a limited group of selected distributors. Fewer outlets... are selling more Edwards chimes than ever before. Less competition... more profit!

Style-wise, they're new and different. So distinctive they make your selling job easier. It's an eye-catching line! And it features exclusive

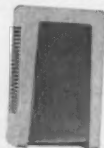
Vibrechord sound. Mellow call of welcome that can be heard all through the house. Rings as long as a finger lingers on the button.

Edwards gives you more to offer... in sight, in sound, in sell.

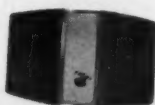
Send for color folder with complete description of excitingly styled, refreshingly different Edwards chimes!

*\*See them! Sleek, modern — no exterior sound chamber tubes to mar their beauty!*

**BOLERO**  
ebony or white...  
2 note and Vibrechord.



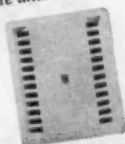
**CADET**  
white or mahogany...  
2 note and single note.



**WEDGWOOD**  
ivory case, 2 note and  
single note. 2 or 3 tubes.



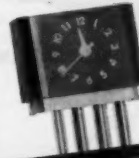
**HIDEAWAY**  
recessed chime, white...  
2 note and Vibrechord.



**MINUET**  
mahogany or white marble,  
2 note and Vibrechord.



**CLARIDGE**  
modern walnut cabinet,  
Westminster melody.



Nationally advertised in  
Better Homes & Gardens  
and House and Garden

now...  
more in sight  
in sound  
in chimes

by **EDWARDS**

- a CANTERBURY...\$79.95
- b CLARIDGE...\$44.95  
with clock...\$69.95
- c HIDEAWAY  
recessed...\$9.95
- d BOLERO...\$7.95
- e MINUET...\$8.95
- f CADET...\$4.95

See, hear, try the new Edwards Door Chimes. They'll catch your eye... caress your ear!

At hardware or electrical dealers—or write for full color brochure and name of nearest distributor.

## NEW EDWARDS DOOR CHIMES

Edwards Co., Inc., Norwalk, Conn. In Canada: Owen Sound, Ontario

And for freedom from fear of fire... Edwards Home Fire Alarm



**4 EXCLUSIVE**

**REASONS WHY...**

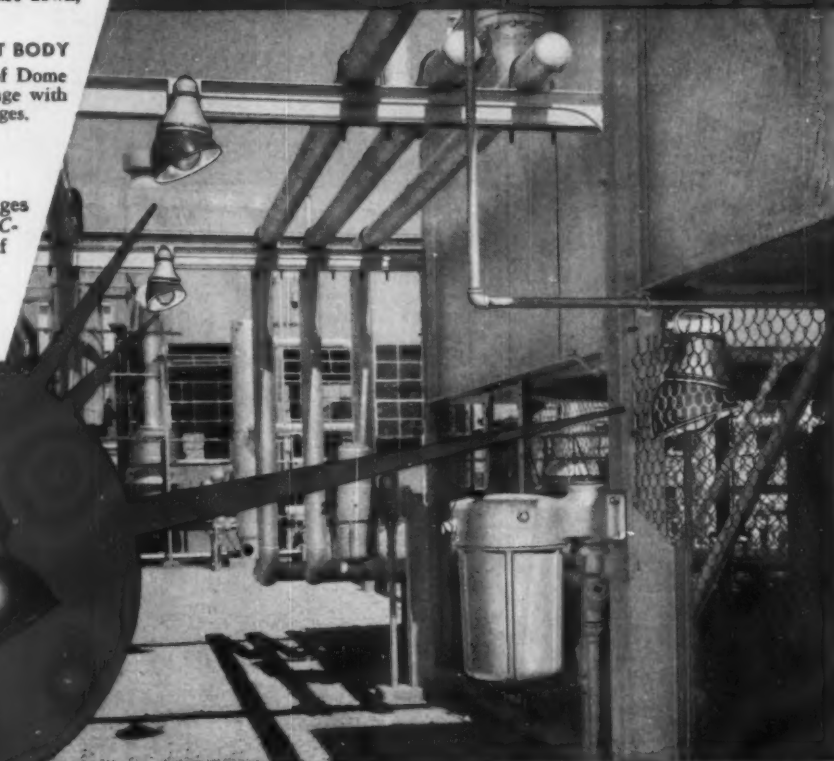
# APPLETON

**Vented  
Explosion-Proof Fixtures  
are BETTER!**

- **"FLAME-TIGHT" CONTACT CHAMBER**  
Exclusive safety chamber prevents explosions even when fixture is serviced with current on! APPLETON Series AA-51 Vented Explosion-proof Fixtures offer the positive protection required for hazardous areas.
- **"FULL-CIRCLE" VENTING**  
Porous metal interior and specially designed hood dissipate heat evenly and safely . . . keep fixture temperature down, provide longer lamp life.
- **"INTERCHANGEABLE" UNILET BODY**  
Standardized diameters at top of Dome Unit Assembly permit interchange with AA-51 fixtures of varying wattages.

*plus*

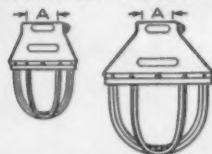
conversion to different wattages or relamping in just **58 SECONDS!** . . . with no loss of man-hours or lengthy shut-downs. Send for complete information today!



**58 SECOND RELAMPING**

Photo Courtesy  
Oil and Gas Journal

**APPLETON INTERCHANGEABLE  
UNILET BODY FEATURE**



Note how identical diameters "A" on Dome Assemblies allow quick interchange of fixtures with different wattages.



Series AA-51 stand-by units are ready at an instant's notice for relamping . . . with handles attached in advance



Only a screw driver is needed to change units . . . and ONLY 58 SECONDS to climb ladder, change unit and descend!



Cleaning fixtures, changing burned out lamps can safely be attended to at bench . . . preventing costly shut-downs.

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Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

# ELECTRICAL CONSTRUCTION AND MAINTENANCE

with plenty of illustrated technical information. The  
Electrical and Electrical Record October 1955

## 55th Year OCTOBER • 1955

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October 1955

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# Sidelights

**REWINDS UP**—A 10% price increase for rewinding and reconditioning electric motors was announced last month by G.E. service shops. It followed a similar boost by Allis Chalmers. The increase is based upon higher costs of copper and other materials as well as operating overhead. The action is particularly welcome to the independents who have been feeling the cost-price squeeze for many months. Some areas, notably along the West Coast, reported price cutting at mid-year, an unhealthy development in an industry which traditionally competes on the basis of quality of service. A moderate price increase at this time is favorable, in fact essential, to the future growth and expansion of this vital segment of the electrical industry.

**PRECISION TESTING**—A new test line at the Okonite plant in Passaic, N. J. exposes every inch of a moving insulated cable to a series of precision tests. A delicate electronic device measures insulation thickness and concentricity (the centering of the conductor in the insulation). The cable moves on to a high voltage ionization test which can detect minute voids or irregularities in the insulation then through an x-ray fluoroscope for visual examination of the cable construction. The test precedes and supplements the conventional final tests on the finished reel.

Exacting tests are an essential part

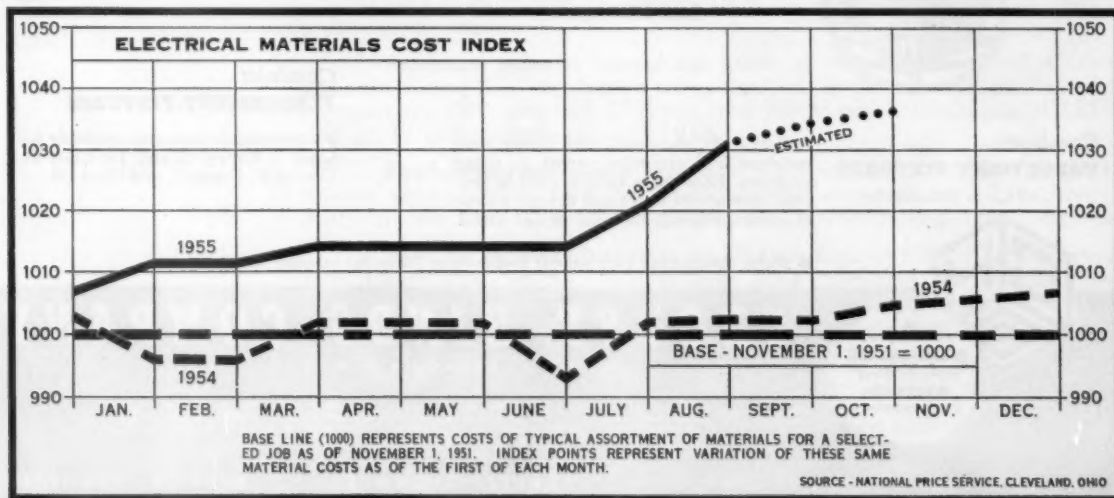
of cable manufacture. The resulting products are the basic working parts of the electrical system. They are continually exposed to electrical and mechanical stresses in service. Yet, once properly installed, we confidently count on them to operate untended within design ratings for a generation or more, performance far beyond anything we demand of any other complex technical product. It is testimony to the fine design, craftsmanship and precision testing of high quality cables that we expect such performance as a matter of course.

**LIGHTING OUTLOOK**—The lighting industry has come a long way in its 76 years, since Edison invented the first practical electric lamp in 1879. And its history has been one of romance, growth, and spectacular developments in new light sources and lighting equipments.

What is the industry's status today and what is its outlook for the future? What are the trends in light sources and in lighting systems design and equipment? To find the answers, we have polled a large number of leading manufacturers of lighting equipment and have made an exhaustive study of lighting equipment volume as related to new building construction dollar volume. The results have been summarized and are presented in our annual lighting feature published in this issue beginning on page 93, under the title of "What's Ahead For Lighting".

**CENTRAL CONTROL**—The great and growing amount of electrical apparatus spread out over large buildings poses a severe and costly operating problem. The vast ventilating and air circulating systems in Chicago's Merchandise Mart is typical. Alfred M. Hall, electrical engineer for Continental Electrical Construction Company, designed a system of low voltage relays and multi-conductor cables connected with a central board to bring the control of 203 motors to one operating station. The result was a substantial cut in operating costs. His article describing the installation "Centralized Low-Voltage Motor Control" begins on page 116.

**ELECTRIC SYSTEMS UNLIMITED**—From Frank O. Davis, Memphis electrical contractor, comes an excellent pamphlet describing a new and challenging residential wiring promotion program. It is sponsored by the Memphis Electrical League. Taking as its theme "Electrical Systems Unlimited" and adapting the design methods described in "Functional Residential Electric System", March 1955, *Electrical Construction and Maintenance*, the plan provides for a unique point system of appraisal, a capacity of 15 watts per square foot and 200-amp service equipment for homes over 1000 square feet in floor area. The ambitious program is certain to arouse nationwide interest. It deserves every encouragement.





COME TO CROUSE-HINDS FOR

# Special Purpose Lighting...



**Condulet\***  
**EXPLOSION-PROOF FIXTURES**

for N.E. Code Class I Locations

Operate at temperatures below ignition temperatures of surrounding explosive gas-air or vapor-air mixtures. Resist internal explosions without damage. Prevent escape of flames to surrounding atmospheres.



**Condulet**  
**DUST-TIGHT FIXTURES**

for Class II Locations

Exclude combustible dusts from interior of fixture. Even when fixture is completely blanketed with dust, temperature of fixture will not cause ignition.

**COME TO  
CROUSE-HINDS**  
**for Free-of-Charge  
Lighting Help...**

CROUSE-HINDS Engineers will survey your layouts for lighting hazardous industrial locations... describe National Electrical Code safety regulations... suggest precautions to observe... recommend UL-approved fixtures for each danger-area, etc.

\*Trade Name Registered



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for Class III Locations

Protect bulb, receptacle and wiring from moisture and corrosive vapors in damp locations. Enclosures are designed to prevent entrance of fibers and flyings, escape of sparks, burning material or hot metal.



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Fluorescent fixtures also available for Class I, Group C and D; Class II, Groups E, F and G; and Class III.

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CONDULETS • FLOODLIGHTS • TRAFFIC SIGNALS • AIRPORT LIGHTING



# Washington Report

---

**Economic indicators point to a continuing and steady rise** in business through 1955 and well into 1956, but some Administration officials consider rising consumer credit and increasing wholesale prices on industrial goods as danger signals. It's too early to appraise the effect of President Eisenhower's illness on the business outlook, and some businessmen say spending plans will be carried out, but reaction on the Stock Exchange indicates caution may be expected until the political outlook becomes more clear.

**Spending for new construction in August** rose to a record \$4 billion, topping off an eight month's record of \$27.1 billion, up 13% over first eight months of 1954, the previous record, the Commerce and Labor Depts. jointly reported. Dollar volume was reported at record levels for private home building, and for commercial building including offices, stores, churches, public schools, sewer and water facilities, public utilities and highways.

**Home building bounced back to 123,000 new starts** in August, after a two-month dip. May starts were 132,000 units, the year's record high. June's total slipped to 129,000, and July's figure fell sharply to 115,000. Early reports indicate September starts will remain high. The annual rate of starts in August was 1,304,000.

**Copper is in short supply** and will likely remain so for some time, but users have stopped paying premium prices as output picks up. ODM is diverting 11,000 tons to industrial use from fourth quarter scheduled allotments to stockpile.

Acquisition of copper in world markets by the U. S. Government, in exchange for surplus farm commodities, was recommended recently by Rep. Patterson (R., Conn.) as an aid in reducing the copper shortage.

Spiraling copper prices and repeated shortages has caused the nation's biggest copper consumer, Western Electric Co., to take steps to switch to aluminum as a substitute. Meanwhile aluminum set another output record in July, of 132,670 tons, as ODM granted Harvey Machine Co. approval (and fast tax writeoff on part of the cost) to build a \$65 million primary aluminum plant at The Dalles, Oregon. ODM is also diverting 75,000 tons of aluminum to industry from the national stockpile as demand continues to soar.

**American industry turned out goods at 140%** of the 1947-49 average rate during August, despite some slack-off in auto output due to model changeovers, FRB reported. This was nine points above July's rate of 131%, and up 17 points above August 1954.

**Employment set a new record** of 65.5 million in August, up half a million workers over July, as unemployment dropped to 2.2 million, or 3.3% of the total labor force, Depts. of Commerce and Labor reported.

**Personal income climbed to an all-time high** of \$304.7 billion annual rate during July, up \$3.1 billion over June rate, and \$17.6 billion over annual rate in July 1954, Dept. of Commerce reported, and ascribed increase to wage hikes for civilian employees of the Government.

**Personal debt hit a record high** in July of \$32.9 billion, up \$425 million over June and \$4.2 billion above a year earlier, FRB reported.

**Man-days lost in July** due to 425 strike-caused work stoppages totaled 3.2 million, involved 900,000 workers, Labor Department reported. This was less than 3.4 million man-days of idleness in June, involving 650,000 workers in 500 walkouts.



PROFIT NOW FROM CONVENIENT, NEW

# BULLDOG *Electrostrip*

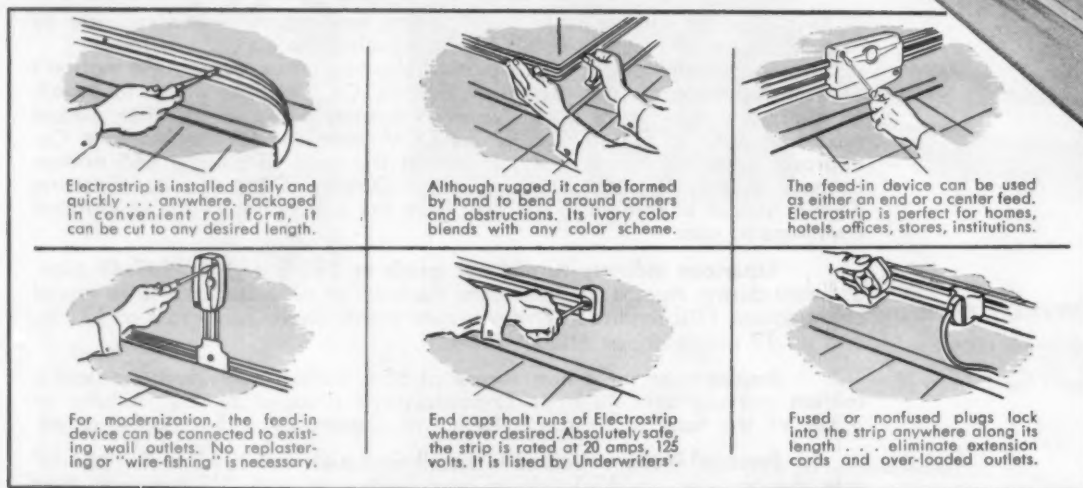
PATENTED



It provides movable outlets...  
eliminates outlet planning!

Here's the most advanced, most convenient electric outlet system ever devised—Bulldog Electrostrip®. Receptacle plugs lock into the strip at any spot along its length—make it *every inch an outlet*. Electrostrip is neat, attractive... can be mounted easily on any surface... and is ideal both for new construction and for modernization.

SAVES INSTALLATION TIME, TOO!



Electrostrip is sold only by Bulldog distributors, only to electrical contractors. See your Bulldog field engineer, or write Bulldog Electric Products Co., Detroit 32, Mich. Free promotion material available.

IF IT'S NEW... IF IT'S DIFFERENT  
... IF IT'S BETTER... IT'S

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**BULLDOG**  
ELECTRIC PRODUCTS COMPANY  
A Division of I-T-E Circuit Breaker Company

Export Division: 13 East 40th Street, New York 16, New York. In Canada: Bulldog Electric Products Company (Canada), Ltd., 80 Clayton Road, Toronto 15, Ontario.





## ABC...and the Reader

**B**ACK IN 1914—forty-one years ago—a group of advertisers, advertising agencies and publishers joined in a project that has come to mean a great deal to the millions who, like you, read business magazines. The project, initiated at a time when circulation claims were rarely verified, was intended to achieve and maintain higher standards of integrity in publishing and advertising practice by providing means to audit paid circulation. Out of that effort came an organization known as the Audit Bureau of Circulations, a voluntary, non-profit, cooperative association, known for short as ABC. Its symbol appears at the head of this page.

We are proud that McGraw-Hill publications were among the founders and charter members of the Audit Bureau of Circulations.

Today the Bureau numbers 3,670 members. These include advertisers, agencies, and publishers of newspapers, farm papers, general magazines and business journals such as this one. These publisher members hold their memberships and their right to display the ABC symbol in their publications only so long as they live up to the circulation standards that are established through the Bureau.

It is one thing to set up high standards; it is another to see that those standards are maintained. This latter and all-important function is performed by a staff of auditors maintained by ABC to check periodically on the circulation practices of the publisher members. When a business magazine, such as this one, joins the Bureau it agrees that the ABC auditors shall have "the right of access to all books and records." Their inspection may dig into the files of original subscription orders, payments from subscribers, paper purchases, postal receipts, arrears of payments, editorial expenses and many other significant items. Sometimes the auditors go behind the records and seek verification of purchase and payment from subscribers themselves.

The information thus obtained and certified by the Bureau then becomes available to the public

and constitutes an authoritative report on the publication's circulation practices.

The advertisers and agencies benefit directly from the ABC because it provides a generally recognized factual yardstick by which the circulations of member publications can be measured and appraised. Every paragraph in an ABC report on a business publication gives the advertisers data that help them make intelligent use of the publication as an advertising medium.

But the ABC renders a service of vital concern to the *reader* as well. The Bureau audits paid circulation only, and it is through this payment, whether by subscription or newsstand purchase, that the reader keeps the editorial policy of a publication responsive to his needs. His decision to buy or not to buy records his judgment on each publication, and the ABC-audited and certified circulation reports make the sum of these judgments known to all concerned.

So the editors of ABC publications must constantly keep their editorial services up to the mark if they are to survive a competition in which the reader's right to buy or not to buy is paramount. Each paid magazine or newspaper will prosper or fail as it wins or loses the voluntary patronage of thousands or millions of readers. And—the ABC is scorekeeper in this vital contest.

Thus the publisher who submits his publication to the supervision and discipline of ABC affirms in the strongest possible manner his recognition that his primary obligation is to his readers and that he owes the standing of his publication to a voluntary demand by those readers.

All this is what makes the ABC brand on a publication so important to its readers. That respected symbol, testifying to the advertising value of the publication, serves also as a constant reminder to all concerned that the reader's willingness to pay for an ABC publication is the basic reason why it stays in business.

*McGraw-Hill Publishing Company, Inc.*



# THE NEW CUTLER-HAMMER LINE

OF HEAVY DUTY, OILTIGHT

## Pushbuttons, Selector Switches and Lights



The new Cutler-Hammer Pushbutton with double pole contact block that measures only  $1\frac{1}{2}$ " in depth.



The new Cutler-Hammer Indicating Light with separate winding transformer that measures only  $1\frac{1}{2}$ " in depth.

**New shallow-depth contact blocks; greater freedom of circuit arrangements; better design; better appearance; better performance. Get them first, get them fast, get them now.**

Once again the name Cutler-Hammer companions great achievement... an amazing and unique new line of heavy duty, oiltight pushbuttons, selector switches and indicating lights. There is nothing to compare with it. The feature that stands out above all is the new basic working unit, the contact block—and its counterpart for the indicating lights, the transformer or resistor. **THIS NEW CONTACT BLOCK MEASURES ONLY 1-3/32" IN DEPTH BEHIND THE MOUNTING PANEL.** A fact of amazing consequence for the vast majority of pushbutton users.

Of even greater consequence is the greater degree of circuit flexibility this new design provides. With its contacts set side by side, "in parallel," electrically isolated from one another... you can apply one voltage on one set, a different voltage on the other. Or you can impress alternating current on one and direct current on the other. Each pair of contacts has its own actuating plunger; you can throw both simultaneously, or singly or in sequence.

And you can add contact block to contact block, one behind another, easily, simply, swiftly, giving you virtually unlimited circuit possibilities.

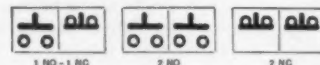
There is a complete range of operators: standard or extended length

pushbuttons, with regular or mushroom head; selector switches providing maintained contact or momentary contact with spring return in either or both positions; key operators providing in addition momentary contact that becomes maintained on key withdrawal. Pushbuttons available in 5 colors. All operators are chrome-plated for lasting beauty. Indicating lights have new wide-visibility lenses proved by light-meter reading to be most visible of all from any angle. Lights are available with resistor or separate winding transformer. Transformer type with 6-volt bayonet lamp provides multiplied lamp life where shock and vibration prevail.

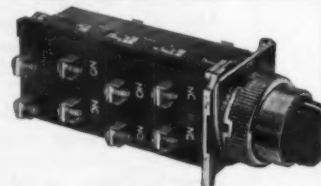
These and many other features are fully described and illustrated in a bulletin just published. Write for it today or see the complete line at your nearest authorized C-H distributor. **CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wis. Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ont.**



New shallow-depth contact block has electrically isolated contacts, allows different voltage or different current on each pair of contacts.



Three separate contact blocks available; with 1 NO and 1 NC contact; 2 NO contacts; or 2 NC contacts.



Double pole contact blocks mount easily one behind another to provide unlimited circuit combinations.



Every type of operator: pushbutton, selector switch and key operator.



**U.S.**  
*Laytex*<sup>®</sup> **ROYAL MASTER**  
**PORTABLE CORDS**

*Have 3 times  
longer cord life!*

**TESTS PROVE IT!**

Here are some of the startling facts:

- 26% greater oil resistance
- 33% greater heat resistance
- 38% greater tension or breaking strength
- 50% greater resistance to cutting
- 58% greater abrasion resistance
- 118% greater resistance to tearing
- 197% greater impact strength
- 488% greater flexibility

Than the average of molded cords of other makes

Your United States Rubber Company sales engineer will call on you to prove CONCLUSIVELY that U. S. Laytex Royal Master is the finest portable cord ever made. Don't place any order for portable cords until you get the full facts about U. S. Laytex Royal Master. Get in touch with us at the address below, if one of our sales engineers hasn't already visited you.



**UNITED STATES RUBBER COMPANY**  
Electrical Wire and Cable Department  
Rockefeller Center, New York 20, N. Y.





1. Throughout the General Petroleum Corporation plant, the heat and corrosion resistance of Rome Synthinol 901 helps protect vital control circuits. This refinery produces a full range of petroleum products and many by-products in chemicals and gases.



## To get the best in INDUSTRIAL WIRING

*look for acceptance by critical users*

Compared to the cost of shutdowns, the *best* equipment and materials cost little whether in refineries, steel mills or most any manufacturing operation. That applies particularly to remote control circuits.

General Petroleum Corporation, Torrance, California has specified Rome Synthinol® Control Cables. The tough Rome Synthinol 901 (polyvinyl chloride) insulation resists high temperatures, moisture, oils, corrosive chemicals or fumes. The protective Rome Synthinol sheath permits installation in conduit or ducts, directly in earth or aerially.

Consisting of as many as 25 individual conductors of 16 AWG, assembled with a 12 AWG common return, these cables assure the customer of trouble-free operation. Because of its high resistance to environmental hazards Rome Synthinol 901 insulation provides long-time protection for individual conductors when fanned out for terminations. Clear and permanent color coding

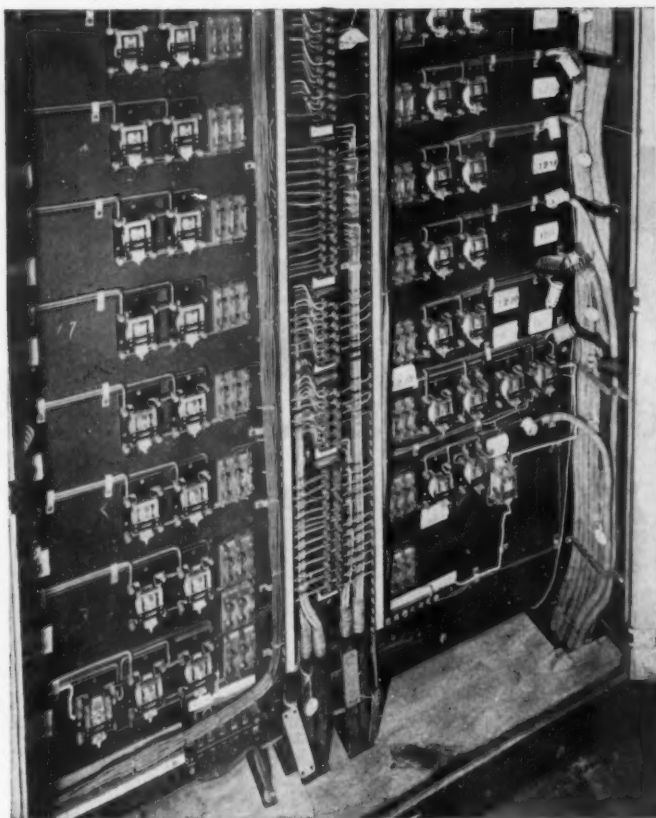
assures proper circuit identification.

Rome Synthinol 901 insulation provides that extra

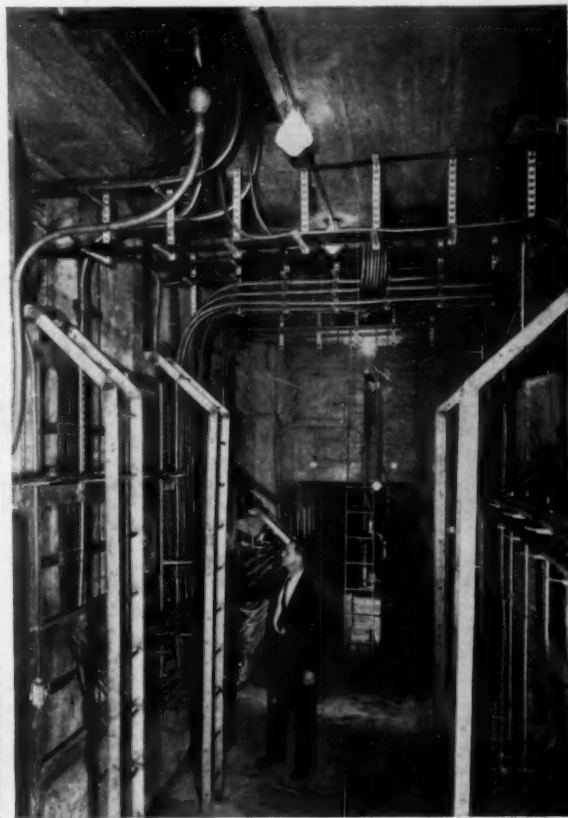


2. Installed in the terminal box for this 200 hp water pump, Rome Synthinol 901 gives extra heat and corrosion protection to start and stop push-button, high pressure alarm, high-level alarm, and low-level alarm circuits.





3. A substantial quantity of multi-conductor Rome Synthinol Control Cables was used to connect plant areas with 16 motor control switch houses.



4. One of the pressurized and temperature controlled underground cable distribution vaults with tunnels going off to left and right.



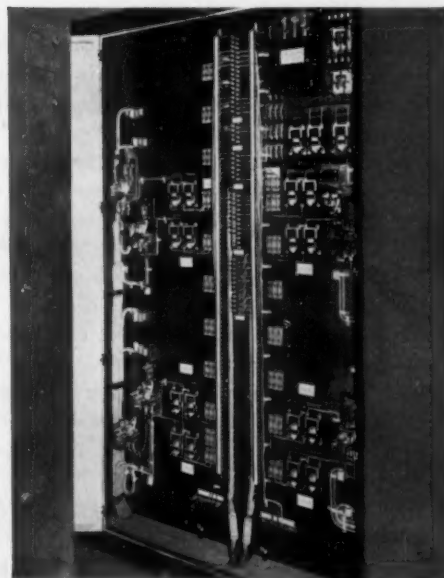
margin of safety which costs so little in the long run. Its long-time dependability has made it the preference of such critical users as refineries, chemical processors, paper and steel mills.

If you have a control circuit problem, it will pay you to check on the economy and dependability of Rome Synthinol Control Cables. Rome engineers will gladly study your requirements. Write or phone your nearest Rome Cable office.

*It Costs Less to Buy the Best*



**ROME CABLE**  
*Corporation*  
ROME • NEW YORK  
and  
TORRANCE • CALIFORNIA



5. One of the 2400-volt motor control relay panels wired with Rome Synthinol Control Cable. Permanently clear color coding makes circuit identification positive, easy.



# HOW CAN A *Friendly* MANUFACTURER HELP YOU IN YOUR BUSINESS?



We at Triangle have an old fashioned idea that what we and our distributors can give you—friendship, help, cooperation, is sometimes more important than the wire, cable or conduit we sell you.

That feeling is strengthened every time we get a letter saying, "You and your distributors sure helped us out of

a jam" or "We can't help but tell you how much we appreciate your cooperation."

When we constantly get such comments, we know that a lot of people are profiting from doing business with Triangle. Perhaps you too will find that your work runs smoother when you do business with Triangle.

*Here are some of the things our field men, in cooperation with a nation-wide network of top electrical distributors, give, every working day—and many a night!*

- Expert, friendly counsel on how to get the most and best wire, cable and conduit for your money.
  - Expert engineering assistance at any point of the job—and for as long as you choose.
  - An expediting service famed for its helpfulness.
- We're not supermen, but if it can be done, we'll do it.

- Printed material, wiring manuals and other literature useful to you many times during the year.
- A spirit of friendliness and helpfulness that will make you feel comfortable when dealing with Triangle.

No matter who you are—contractor, engineer, maintenance man—no matter who you work for—utility, city, contracting firm, large industrial—

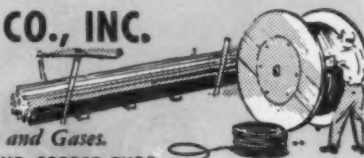
## YOU'LL LIKE DOING BUSINESS WITH TRIANGLE!

### TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY



*Manufacturers of Arteries for Electricity, Liquids and Gases.*  
WIRE • CABLE • CONDUIT • PLASTIC PIPE • BRASS AND COPPER TUBE





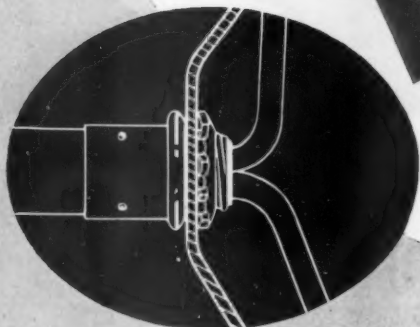
# Red Throat

**B-M 21B, THE NEW INSULATED THROAT  
INDENTER  
CONNECTOR  
FOR E.M.T.**

*Four Ways  
Finer*



- 1** Protruding rounded red plastic lip of bushing prevents cutting of insulation—eliminates shorts.
- 2** Full thread screws into all conduit fittings. Lip of RED THROAT bushing protects thread from damage.
- 3** Deep dished eight pronged lock nut is easier to drive on—screws flush to shoulder and digs into metal of box for vibration proof positive ground.
- 4** Permanent locked-in bushing insures smooth burr-free raceway for easy fishing. No extra work and costs no more.



Briegel, the Original Indenter Fittings are neater in appearance, easier and faster to use. Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job!

**ALL BRIEGEL FITTINGS ARE U. L. APPROVED AS CONCRETE-TIGHT**

Order from Your Wholesaler!

All B-M Indenter Fittings are U.L. Approved as concrete-tight and for general use (File Card E10863). Also comply With Federal Specifications W-F-406.



**BRIEGEL** METHOD  
TOOL  
CO.  
GALVA • ILLINOIS

Warehouse Stocks in Principal Cities for Immediate Delivery!



ANOTHER EXAMPLE OF

*Cope*

EFFICIENCY...

**COPE 70,000 SERIES CABLE TROUGH  
WITH THE BUILT-IN COUPLER  
now available in 12' length  
33% fewer connections**



The new Cope 70,000 Series Cable Trough with the built-in Coupler is now available in 8, 10, and 12 foot lengths, and affords you 80% SAVINGS in assembly time, PLUS 33% FEWER CONNECTIONS.

These features alone mean real savings for you, in time and money.

\*PATENT  
PENDING

*Cope*

**T. J. COPE, INC.**

**711 SOUTH 50th ST., PHILADELPHIA 43, PA.**



# LOOK!

## A Dry-Type Transformer with Class H Insulation

(150 C Rise)

Here's a completely new line of totally enclosed dry-type transformers with Class H insulation. Maintenance is completely eliminated. Dust and dirt are kept out. No more worrying about the effect of lint or moisture in the atmosphere. You can use them indoors or outdoors — they are completely weather-proof. And the compact Allis-Chalmers design gives you lower weights, reduced dimensions. In many cases installation will be less costly, easier.



**All these advantages  
at little or no extra cost!**



Best of all, there is no increase in cost in ratings 10 kva and below, single phase, and 30 kva and below, three phase. A slight increase in cost of higher ratings is more than offset by the many new advantages.

The tank is simple and sturdy — it has four formed corners and only one welded seam. The bottom plate is recessed and held to the case by bolts for quick removal. The coil is given maximum protection with expensive Class H insulating materials. The unit is designed for 150 C rise. The result is a convenient, compact transformer that will give years of satisfactory operating life.

For more information call your nearby Allis-Chalmers distributor or district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4529

# ALLIS-CHALMERS





## The SUBURBAN

... with Extruded Plastic Diffuser



S240 2 lamp 48" Rapid Start

S220 2 lamp 24" Trigger Start

S420 4 lamp 24" Trigger Start

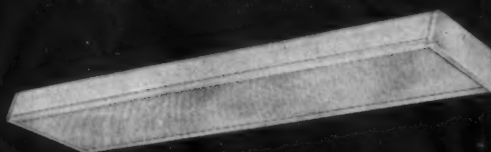
S440 4 lamp 48" Rapid Start

TYPICAL PERFORMANCE CURVE



## The MERCHANT

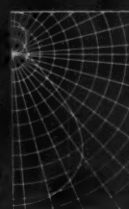
... with Lucite® Diamond Lens



M242 2 lamp 48" Rapid Start

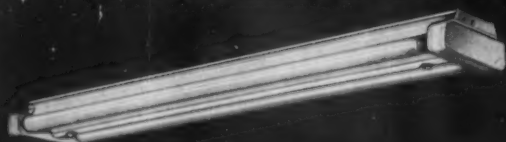
M442 4 lamp 48" Rapid Start

TYPICAL PERFORMANCE CURVE



## The SUPERMARKETER

... for high levels of illumination



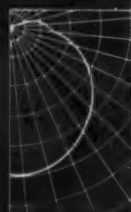
72B4 2 lamp 48" Rapid Start

72B8 2 lamp 96" Rapid Start

74B4 4 lamp 48" Rapid Start

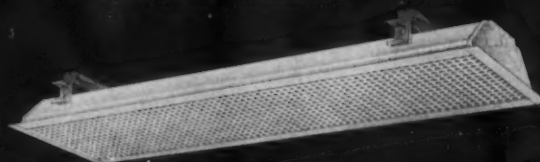
74B8 4 lamp 96" Rapid Start

TYPICAL PERFORMANCE CURVE



## The Packaged TROFFER

... with Plastic Louver



T240 2 lamp 48" Rapid Start

TYPICAL PERFORMANCE CURVE



# NOW! LIGHTING SELECTION MADE

... with the new Miller Merchandise Line of

Here is a completely new concept in modern lighting—four basic fixture types with tremendous flexibility and unusually broad application. Slim and handsome in appearance, they provide new highs in lighting efficiency and meet the most exacting requirements for modern layout planning and ease of installation.

Styled by one of America's leading architect-designers, the SUBURBAN and the MERCHANT are strikingly handsome fixtures, extremely shallow with smooth, trim, modern lines. The Packaged TROFFER, only 4½" in depth (fits any 5" recess) is complete with lay-in enclosure, integral side and snap-on end trim flanges, adjustable hanger brackets and Universal furring clips. The SUPERMARKETER is designed to provide high levels of illumination in modern merchandising areas.

The Miller Merchandise Line goes hand-in-hand with today's increasing trend for lower ceilings. When flush mounted, The SUBURBAN, MERCHANT and SUPERMARKETER provide even ceiling illumination so necessary in minimizing glare and contrast. When stem-suspended, special top apertures produce additional upward light.

#### ADDITIONAL ADVANTAGES of the MILLER MERCHANDISE LINE

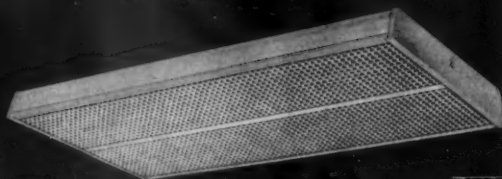
- Hot-sprayed baked enamel on Bonderized 20-gauge steel
- Newest plastics for continuing light stability; guaranteed free from discoloration, warpage for one year
- Bonderite, UL, AFL-IBEW Labels
- All fixtures wired with ETL Certified HPF ballasts ... readily accessible for very easy maintenance

Ask your Miller representative for complete information about the new MILLER MERCHANDISE LINE



## The **MERCHANT**

... with Plastic Louver



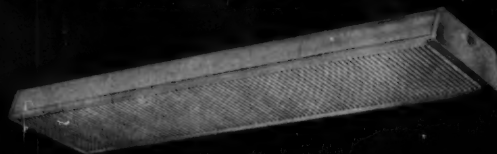
M440 4 lamp 48" Rapid Start

M240 2 lamp 48" Rapid Start

TYPICAL PERFORMANCE CURVE ➡

## The **MERCHANT**

... with Corrugated Plastic Enclosure

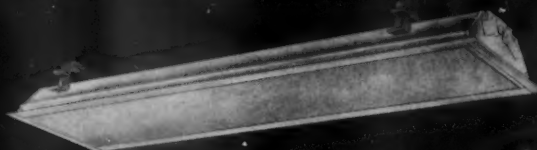


M100 2 lamp 48" Rapid Start

TYPICAL PERFORMANCE CURVE ➡

## The *Packaged* **TROFFER**

... with Lucite® Diamond Lens

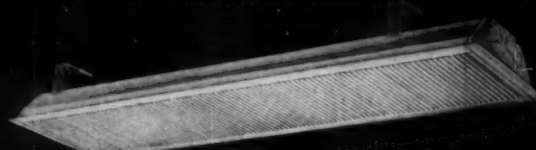


T242 2 lamp 48" Rapid Start

TYPICAL PERFORMANCE CURVE ➡

## The *Packaged* **TROFFER**

... with Corrugated Plastic Enclosure



T244 2 lamp 48" Rapid Start

TYPICAL PERFORMANCE CURVE ➡

\*(R)DuPont Co.

# EASIER THAN EVER BEFORE

*completely-packaged fluorescent fixtures!*

**JUST 4 BASIC FIXTURE TYPES** ... all Rapid Start\*, all Engineered for Quality Illumination and Peak Performance... for Modern Lighting in Stores, Schools, Offices and Public Buildings

\* EXCEPT MODELS 5220 & 5420

**miller**  
SINCE 1844

GENERAL OFFICES, MERIDEN, CONN.  
FACTORIES: Utica, Ohio — Meriden, Conn.  
In Canada: Curtis Lighting of Canada Ltd., Toronto

THE MILLER COMPANY, Illuminating Division  
99C Center Street  
Meriden, Connecticut

Please send me your complete catalog on the new  
MILLER MERCHANDISE LINE

Name.....

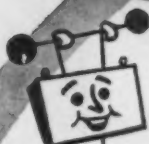
Company.....

Address.....





# PRECISION on your transformer is more than a name ...it's a guarantee!



## Full Rated Load

Carry full loads continuously ... capable of handling emergency over-loads.



## Economical

Low initial cost ... inexpensive operation and maintenance.

## PRECISION ...

the only transformer backed by a 5-year guarantee! Only Precision offers this important long-range protection ... your assurance of superior design, material and workmanship. Reduce costly repair work ... power failure worries ... work stoppages! Be precise — install Precision.



## Dependable

Ruggedly constructed to exceed latest NEMA standards!



## Quiet

Unsurpassed for smooth, silent operation.



## PRECISION 5 year GUARANTEE

Manufactured products bearing the trademark or nameplate of this company have been thoroughly inspected and are guaranteed to be free from defects in workmanship or materials. The Company's liability without charge or replacement is limited strictly to replacing without charge or repairing prepaid, any part or parts which within five (5) years from date of shipment from our factory, shall be found to have defective workmanship or material or shall otherwise fail to meet specifications. We are not responsible for repairs or replacements made by others without our written authorization.

## Easy to Service

New handy panel board gives quick access to all taps.



SINGLE AND 3 PHASE

1/4 to 1500 KVA ... Voltages to 15 KV.

Available with any make switchgear in substation units.

Write today for FREE Catalog and valuable technical data charts.



# PTC

## PRECISION TRANSFORMER CORP.

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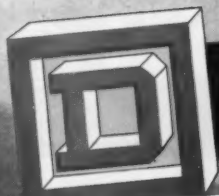
**OVERWHELMING FIRST CHOICE FOR 50 YEARS**

Compare **SQUARE D** SAFETY SWITCHES...  
line for line and feature for feature

**THEY COST NO MORE... WHY SETTLE FOR LESS?**

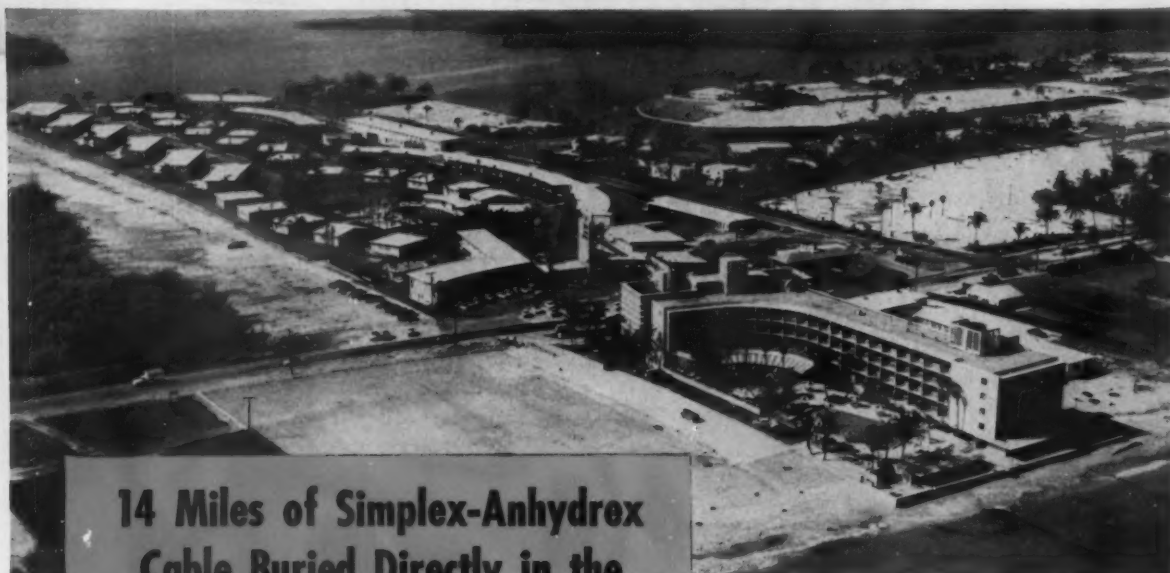


ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS



**SQUARE D COMPANY**





## 14 Miles of Simplex-Anhydrex Cable Buried Directly in the Earth at 28-Acre Florida Motel

Florida hotel-motel development, where ANHYDREX Cable is buried, showing Atlantic Ocean (lower right) and part of Biscayne Bay (upper left).

**Installed in four miles of trenches to guard against  
tropical storms and preserve resort atmosphere**

This swanky 650-room motel development, just completed in Miami Beach, depends almost entirely on Simplex-ANHYDREX 600-volt cable for power for air-conditioning, lighting and a myriad of other uses.

One of the largest direct-burial, underground distribution systems of its type in the South, the cable is insulated with Anhydrex which

resists water, heat and oxidation.

A neoprene jacket protects it against soil acids, abrasion, oil, moisture and mildew.

For economical, safe, neat-looking direct burial, underground distribution systems, investigate Simplex-ANHYDREX Cable.

Call the Simplex representative nearest you, or write to the address below.

# Simplex

## ANHYDREX Cable

A product of SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Massachusetts



*for*

# DECORATIVE LIGHTING

## UNION PIN - TYPE SOCKETS

To get the quality and dependability you expect, remember to specify Union. Union Sockets and Streamers are available at qualified wholesalers from coast to coast. Our long experience and rigid manufacturing controls are your assurance of completely satisfactory installations.

MEDIUM

INTERMEDIATE

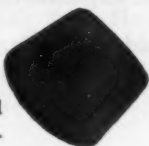
CANDELABRA

STREAMERS

10 - LITE STAR

### Remember!

Union's handy cap wrench is furnished with every carton of pin type sockets.



*The job "goes fast"*

NO STRIPPING  
NO SOLDERING  
NO TAPING



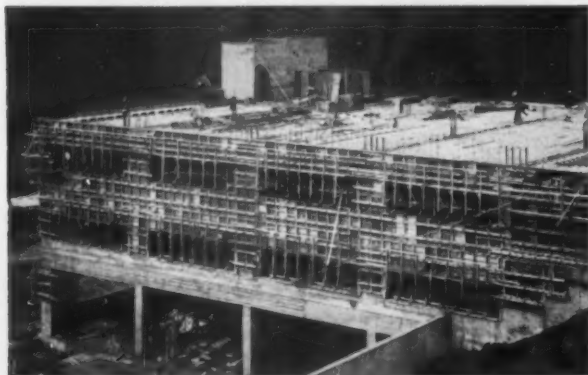
UNION INSULATING COMPANY, Parkersburg, West Virginia



# Here's how Republic "Inch-Marked" E.M.T.<sup>®</sup>



Republic "Inch-Marked" E.M.T. will be cast in the concrete on this pan-type construction job. It's approved by the National Electrical Code for concealed, exposed and concrete installations.



University of Oregon Dental School, Portland, Ore. Electrical Contractor: Ace Electric Co.; Architect: Lawrence Tucker & Wallman; Consulting Electrical Engineers: George Pittingell, Grant Kelly Co.; Electrical Wholesaler: Graybar Electric Co., all of Portland, Oregon.

## pays dividends

It did on this job at the University of Oregon for the electrical contractor, Ace Electric Company, Portland, Oregon. Features of Republic "Inch-Marked" E.M.T. made installation easy. High quality and consistent uniformity of the tubing assured good fabrication and a dependable job.

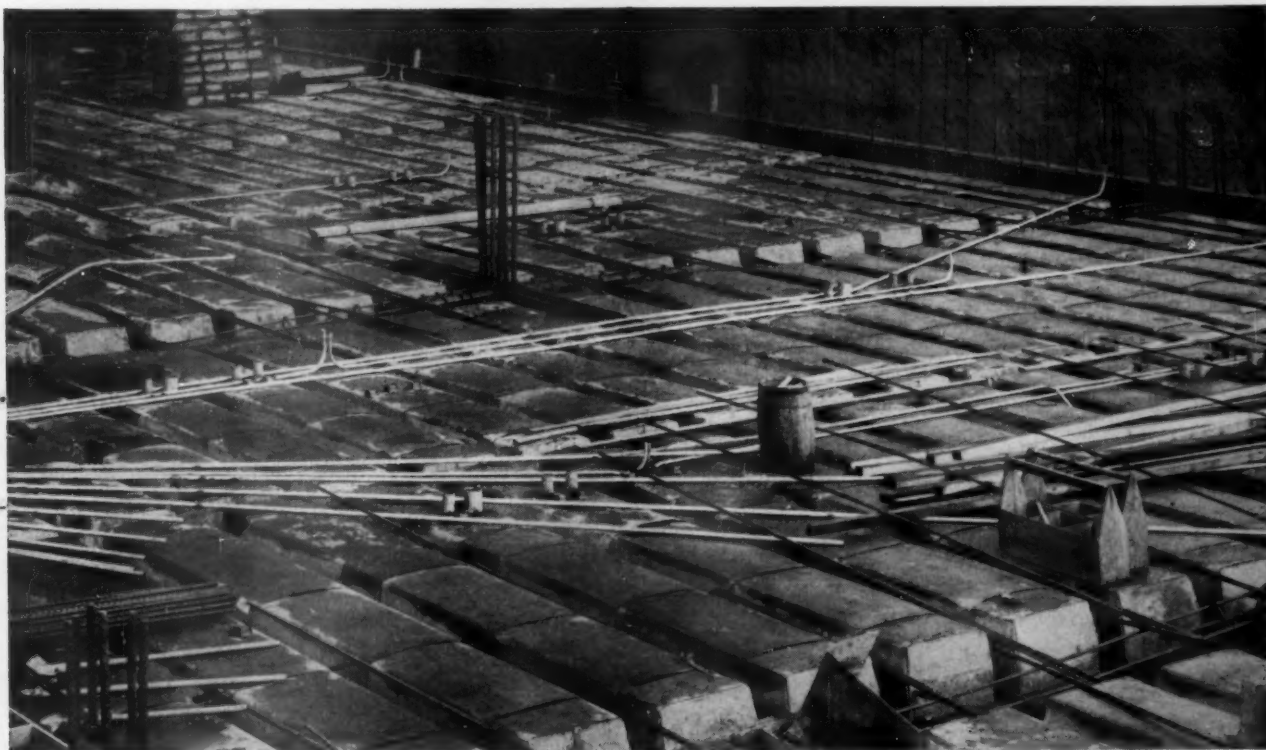
The exclusive "Inch-Marked" feature of Republic E.M.T. eliminated wasted effort. Electricians didn't have to measure it. They cut the tubing at the "Inch-Marks". They were able to make smooth, accurate bends simply by lining up the "Inch-Marks" on the tubing with those on the Republic Calibrated Bender.

Inside-knurling, another exclusive feature of Republic E.M.T., simplified wire-pulling.

## REPUBLIC

*World's Widest Range of Standard*





## in the long run

Everyone likes Republic E.M.T. because it makes work easier. There are fewer tools to carry around. No threads to cut. Republic E.M.T. is quickly joined using Underwriters' Laboratories' approved couplings and connectors.

And Republic E.M.T. is approved by the National Electrical Code for exposed, concealed and concrete installations. This is important on jobs like schools, hospitals, other institutions. Republic E.M.T. also carries the inspection seal of Underwriters' Laboratories and meets A.S.A. Specification C80.3.

Take advantage of these long-run dividends on your next job. Order Republic "Inch-Marked" E.M.T. from your distributor. Mail the coupon for additional information.

\* E. M. T. means ELECTRICAL METALLIC TUBING.

# STEEL

*Steels and Steel Products*



**FOR VERY SEVERE CORROSIVE CONDITIONS** Republic Dekoron-Coated E.M.T. is the answer. Its tough, polyethylene coating over the galvanized finish gives double protection to electrical raceways. Moisture-tight joints are easily made using threadless connectors and couplings. Joints are sealed with a tape. Dekoron-Coated E.M.T. provides an economical maintenance-free raceway that resists corrosion and reduces costs.

**REPUBLIC STEEL CORPORATION**  
Steel and Tubes Division  
212 East 131st Street  
Cleveland 8, Ohio



Please send information on:

- ☐ Republic "Inch-Marked" E.M.T.
- ☐ Dekoron-Coated E.M.T.

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

E-8148





## I-T-E URELITE AIR CIRCUIT BREAKERS PERFORM THESE 2 IMPORTANT FUNCTIONS:

- provide sure protection against harmful overloads and other faults in individual circuits
- provide sure protection of personnel against injury from accidental contact

Protection of individual circuits against harmful overloads and other faults pays off in a minimum of downtime: production is steadier, profits higher. Protection of personnel pays off over and above the human values: increases production, lowers insurance rates. The safety offered by I-T-E Urelites is complemented by simplicity of design, ease of operation, economy of maintenance.

I-T-E Urelites are available through your local I-T-E distributor in four types of enclosures: general purpose, panel-mounted, weatherproof, and dustproof; and with auxiliary and tripping devices to fit specific applications. Ask him for literature or, if more convenient, write I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Philadelphia 30, Pa.



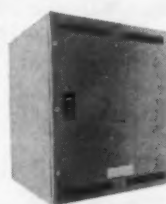
I-T-E Type KA. 15,000 amp interrupting capacity. 15-225 amp continuous. 600 v a-c, 250 v d-c. 2, 3 and 4 pole.



I-T-E Type KB. 25,000 amp interrupting capacity. 40-600 amp continuous. 600 v a-c, 250 v d-c. 2, 3, 4 pole.



I-T-E Type KC. 50,000 amp interrupting capacity. 200-1600 amp continuous. 600 v a-c, 250 v d-c. 2, 3 and 4 pole.



I-T-E Type LG. 75,000, 100,000 amp interrupting capacity. 2000-6000 amp continuous. 600 v a-c, 250 v d-c. 2, 3 pole.



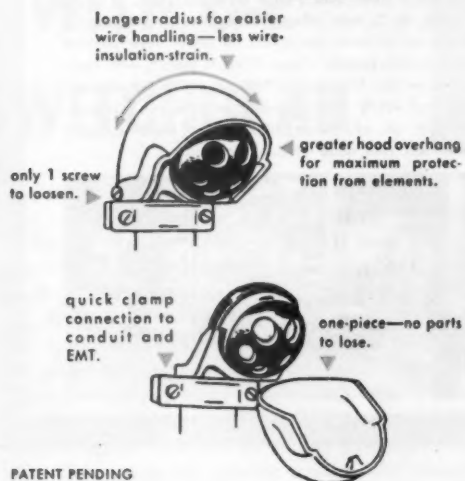
**I-T-E  
CIRCUIT BREAKER  
COMPANY**

**SWITCHGEAR DIVISION**





# new "swing top" entrance cap with the hood that hangs on a hinge!



PATENT PENDING

## FOR EASIER, COST-SAVING INSTALLATION

● Cut entrance installation time by *two-thirds* with Efcor's new "Swing Top" entrance cap. Loosen one screw, swing the hood open . . . that's all it takes to pull wires through the head! The patented, one-piece hinged construction retains the hood until you're ready to replace it. With conventional units, you're required to loosen several screws, completely remove the cover, put it in your pocket, or on the ladder where it might fall to the ground. "Swing Top" also has a longer radius to facilitate wire pulling and minimize strain on wire insulation. The rugged clamp connector permits quick attachment to conduit *directly against the wall*. No threading, no offsetting needed . . . accommodates EMT too.

WRITE FOR FREE SAMPLE or see your *Electrical Distributor*.



**electrical fittings corporation**

37-50 57th STREET • WOODSIDE 77, NEW YORK



# Are unused "horses" eating your profits?



## save money by matching the load . . . let silicones carry the overload!

Dow Corning Silicone insulated (Class H) motors give you a service factor ranging up to 50% compared with 15% for Class A.

This extra service factor enables you to install Class H motors rated at normal load requirements and yet meet initial or intermittent overloads, or loads that can't be matched in standard frame sizes.

In one of our fluid pumping applications, for example, normal load is 5 hp; intermittent loads range up to 9.2 hp. Instead of following the old fashioned practice of overmotoring with a 10 hp Class A motor, we use a 5 hp Class H motor and let silicones carry the overloads.

That means less capital investment in motors. It also means a better power factor and higher efficiency because smaller silicone insulated motors operate nearer full load more of the time than larger motors rated to meet maximum overloads.

And you get more reliable operation because motors insulated with Dow Corning Silicones have superior resistance to heat, and moisture and to corrosive atmospheres.

## Remember, overmotoring is outmoded

Dow Corning Corporation, Dept. 3910, Midland, Mich.

Please send me sources of supply for new Silicone (Class H) ☐ Motors ☐ Transformers

☐ Information about Sier-Bath pumps with Class H motors

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

**DOW CORNING  
SILICONES**

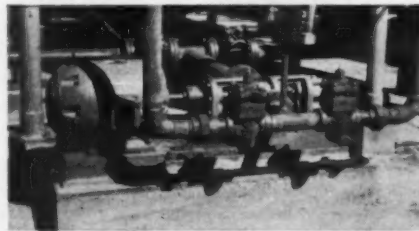
**DOW CORNING CORPORATION**  
MIDLAND, MICHIGAN

ATLANTA • CHICAGO • CLEVELAND • DALLAS • DETROIT  
LOS ANGELES • NEW YORK • WASHINGTON, D. C. (Silver Spring, Md.)

CANADA: Dow Corning Silicones Ltd., Toronto  
GREAT BRITAIN: Midland Silicones Ltd., London  
FRANCE: St. Gobain, Paris

### *to help you avoid overmotoring*

Sier-Bath Gear and Pump Company, Inc. of North Bergen, N. J., now offers silicone insulated (Class H) motors as optional equipment on all of their positive displacement pumps. These Class H motors with their built-in service factor permit you to match the average load and safely carry initial or intermittent overload. You get all of the advantages of more compact equipment and more efficient operation.







**G-E INDIVIDUAL BREAKERS** also feature easy installation, plus lower cost. Installation of high-quality equipment results in greater customer satisfaction, higher reputation and more profitable business.

**CONTRACTORS!**

# YOU CAN SAVE MONEY WITH G-E SWITCHGEAR

When your plans call for load-center unit substations, draw-out switchgear equipment or individually mounted circuit breakers, it will pay you to check G.E. first. Competitively priced, General Electric low-voltage switchgear has extra quality features that can offer considerable savings in installation, connection, and maintenance. You'll find that these G-E features will pay off in dollars and cents:

**NEW LOW COST**—General Electric has increased the interrupting ratings of Type AK air circuit breakers by as much as 50%. This means you can use smaller, and consequently less expensive, breakers all down the line . . . save up to 33%.

**FASTER, EASIER INSTALLATION**—Shipped to you factory assembled and pre-tested, G-E switchgear arrives ready to

**FASTER INSTALLATION** of General Electric switchgear is made possible because of pre-assembly and pre-testing at factory. No bus for you to install; no "bugs" to iron out.



connect into the system. You save by cutting expensive man-hours to a minimum.

**YEARS OF USER SATISFACTION**—When you convince your customers to specify equipment of G-E quality you not only run less risk of losing profits through installation difficulties and expensive call-backs—you also build a reputation for high-quality work that will bring in more business.

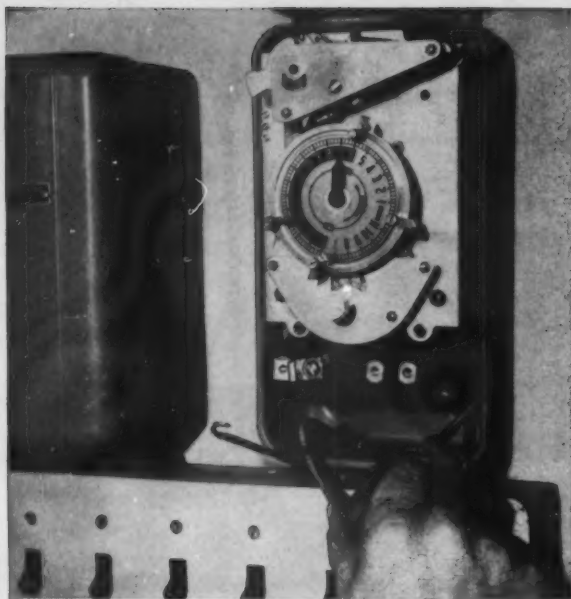
**FOR MORE INFORMATION**, see your G-E Apparatus representative, or write for bulletins GEA-3592, Load-center Unit Substations; GEA-5916, Drawout Switchgear; GEA-5915, Air Circuit Breakers. General Electric Company, Schenectady 5, New York.

523-4

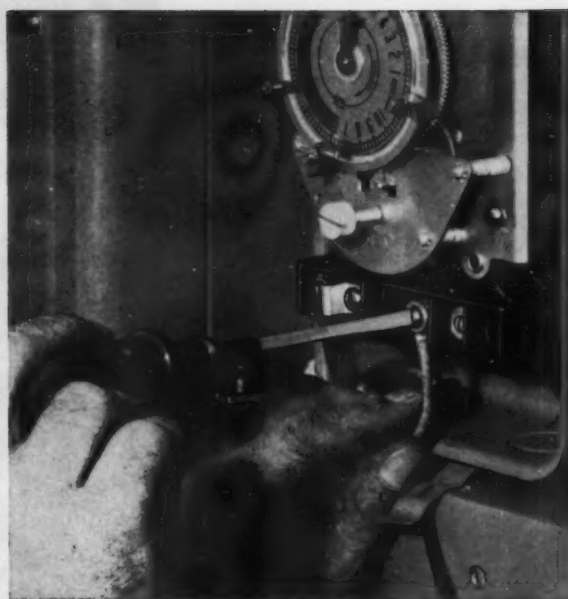
*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**



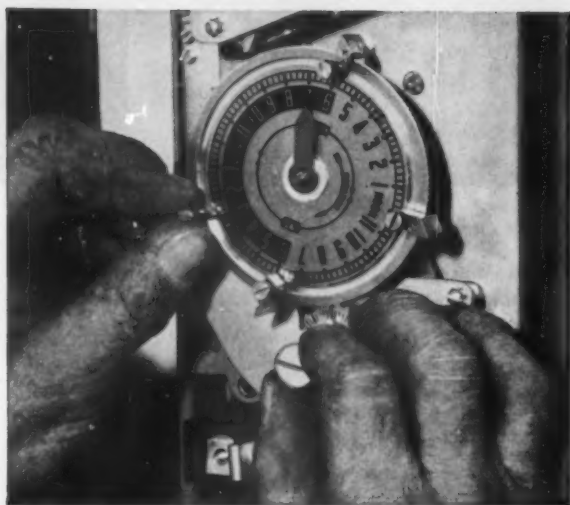


**1 ATTACH SWITCH TO MOUNTING SURFACE:** Hang by means of lug at top, secure with two screws through holes in case—takes only a few seconds; rugged, drawn-steel housing makes T-27 suitable for any outdoor-indoor installation.



**2 WIRE:** Connect to clearly marked, readily accessible terminal blocks at front of T-27—requires little time. A minimum of circuit connections, maximum hand room below terminals and five double knockouts facilitate quick wiring.

## Reduce Installation Time With Dependable General Electric Time Switches



**3 SET DIAL:** Adjust to correct time, position trippers for desired on-off period—easy as setting a wrist watch. With omitting device, T-27 skips days; with astronomic dial, follows dusk-dawn schedule; performs 10 on-off operations daily.

### 3 Simple Steps Make Installation of General Electric's T-27 Time Switch Extremely Fast and Easy

**ONCE INSTALLED** and set, the T-27 will give years of reliable, dependable on-off control.

**ACCURATE TIMEKEEPING** is assured by a self-starting, self-regulating, permanently lubricated Telechron\* motor, sealed to keep out dirt and dust.

**RUGGED CONSTRUCTION** insures little maintenance. All parts of T-27 switch mechanism subject to heavy duty are made of copper-nickel-plated steel, and switch blades are of beryllium copper for the best combination of mechanical and electrical characteristics.

**FOR MORE INFORMATION** on T-27, contact your nearest authorized G-E Time Switch distributor. Ask for G-E Time Switches at his store; and write for Bulletins GEA-5965 and GEC-535C to Section 603-168, General Electric Company, Schenectady 5, N. Y.

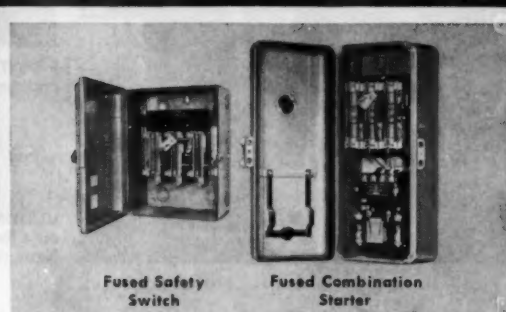
\*Reg. Trade-mark of General Electric Co.

GENERAL  ELECTRIC





G-E Type CLF fuses are available in a complete range of low-voltage (600 volts and below) applications where high interrupting capacity is needed.



# HIGH INTERRUPTING CAPACITY FUSES FOR LOW-VOLTAGE POWER CIRCUITS

Are you sure that your fuses are adequate  
to clear any short circuit?

As industrial and commercial power systems have grown in size, the short-circuit capacity of many circuits has become so great that conventional fuses can no longer provide adequate protection. A few years ago short circuits were usually between 5,000 and 15,000 amperes. Today, these short circuits may soar as high as 30,000 to 100,000 amperes.

You can't afford to take chances when it costs so little to have adequate fusing—and when the results of inadequate protection can be so costly. Using fuses with inadequate interrupting capacity can result in unnecessary service interruptions, damage to equipment and injury to personnel.

The silver-plated CLF fuse will fit any standard NEC fuse holder of the same voltage and current

rating. However, special fuse clips are available which will accept only the CLF fuse. Their use is recommended to prevent inadvertent substitution of conventional fuses having inadequate interrupting capacity.

Fuses are available from your local G-E Apparatus Distributor. For more information, send the coupon below for bulletin GEA-6319, General Electric Company, Schenectady 5, N. Y.

Section D522-2  
General Electric Company  
Schenectady 5, New York

Please send me a copy of bulletin  
GEA-6319, TYPE CLF CURRENT-LIMITING FUSES.

NAME.....  
COMPANY.....  
STREET.....  
CITY..... ZONE..... STATE.....

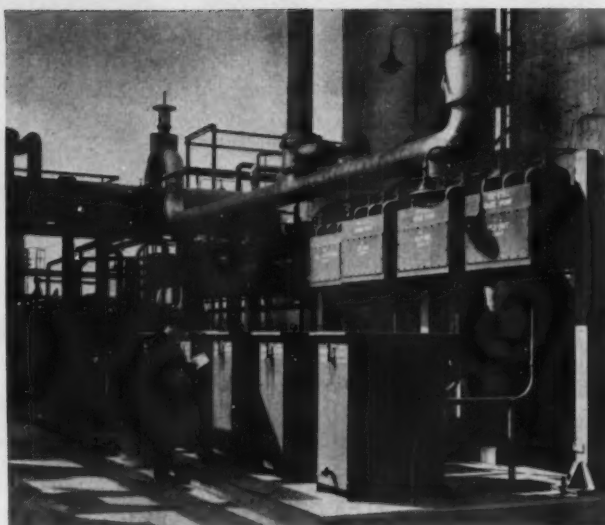
*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**





**COMPLETE LINE** of G-E oil-filled cutouts includes pole, pothead and subway types and metal-enclosed assemblies.



**INDUSTRIALS**, such as this oil refinery, use these three-phase metal-enclosed G-E oil-filled cutout assemblies to protect equipment.

**UTILITIES** with underground systems use G-E oil-filled subway-type cutouts for single phase or three phase, gang-operated, fusing or switching. Expansion chambers are required to secure full interrupting rating.

## For best in low-cost switching...industrials, electric utilities choose G-E oil-filled cutouts

**Indoors or outdoors, they permit substantial savings on first cost and fuse replacement—combine high interrupting capacity, safer operation and long life**

For utility, industrial, commercial and institutional applications that combine overcurrent protection and load-break switching, more and more companies are choosing General Electric oil filled cutouts.

**HERE'S WHY:** Low-cost G-E oil-filled cutouts provide high interrupting capacity . . . up to 11,000 rms amperes. They provide for maximum safety of personnel . . . all arcing occurs under oil and all flame, noise and electrically live parts are confined within a metal housing. And G-E oil-filled cutouts offer long service life since interrupting ratings are based on test conditions far more severe than those normally encountered in operation.

**IDEAL INDOORS OR OUTDOORS** G-E oil-filled cutouts are quiet in operation, and they may be wall or direct-to-equipment mounted. Single- or three-phase metal-enclosed assemblies provide for all wiring and electrical connections to be completely enclosed in a grounded steel cabinet. Entrances can be provided for connection to outgoing cables.

### Other G-E oil-filled cutout features include:

- Simple fusing, even on gang-operated assemblies. Pre-formed fuse links easily slip into place.
- Silver-plated self-aligning contacts of heavy forged copper with special arcing tips . . . minimize wear.
- Leads brought into cutout housing above oil level—no gasketed joints under oil pressure.
- Pole and pothead types do not require expansion chamber for full interrupting capacity.

If you have an application that requires overcurrent protection *plus* load-break switching, it will pay you to investigate G-E oil-filled cutouts. Available for 2400-, 4330- and 7200-volt circuits, they can mean substantial savings in initial costs and fuse replacements.

For complete information, contact your nearest G-E Apparatus Sales Representative, or write for bulletin GEC-863, General Electric Company, Schenectady 5, N. Y. 43-12

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USE TABS FOR DETAILS OF . . .



**POWER  
DISTRIBUTION**

SAVINGS

SYSTEM

PRODUCTS

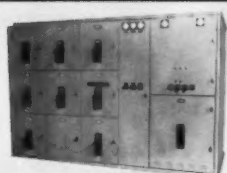
# Save up to 25% with G-E equipped power distribution systems for commercial buildings

**YOU BENEFIT THREE WAYS FROM G-E  
EQUIPPED 480Y/277-VOLT DISTRIBUTION:**

1. First-cost savings
2. Expansible, efficient system
3. Single equipment source

This system can help designers, owners, builders save 10 to 25 per cent on initial costs. Higher-voltage distribution provides an effective answer to today's heavy electrical loads. Its flexibility and economy allow realistic anticipation of the even larger loads of tomorrow.

## GREATEST SAVINGS FROM . . .



PROTECTIVE DEVICES



RISERS AND FEEDERS



INSTALLATION



LARGE MOTORS AND CONTROL

*Progress Is Our Most Important Product*

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FOR GUIDE TO  
YOUR OWN  
SAVINGS  
MAIL COUPON  
ON LAST PAGE  
OF THIS AD



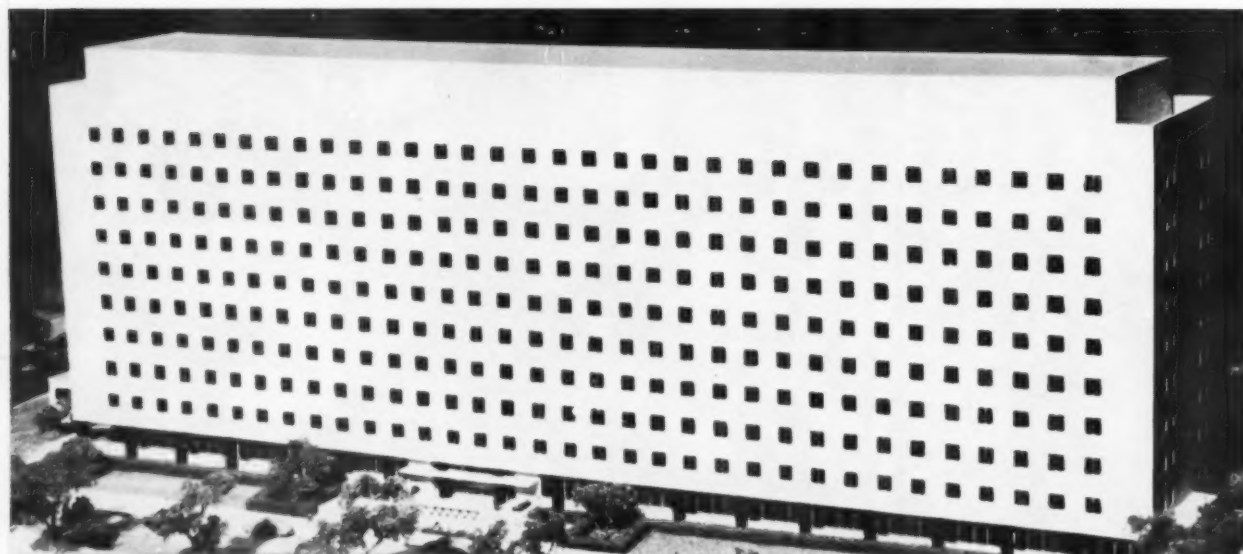
**\$1,500,000 SAVINGS** on equipment were obtained when system was selected for New York Coliseum. Combining 365,000 square feet of display space with 26-story building presented unique

opportunities for savings with higher-voltage system. Leon and Lionel Levy, architect; Guy B. Panero Engineers, consulting engineers; Walsh-Fuller-Slattery, general contractors; Jackson-Livingston, electrical contractors.



**\$12,000 SAVINGS** resulted at Twin Falls, Idaho high school with 480Y/277-v system even though 120-v load was large percentage of

total. One of the earliest applications of new system, school is ideal example of savings possible in small horizontal buildings. Entire load for school totals only 600 kva.



**\$20,000 SAVINGS** were obtained with 277-v lighting in Pennsylvania's new office building for the Dept. of Property & Supplies, Harrisburg, a Gen. State

Authority project. Here system proves value in longer, lower building. Lacy, Atherton and Davis, architects and engineers; The Howard P. Foley Co., electrical contractors.





**POWER  
DISTRIBUTION**

SAVINGS

SYSTEM

PRODUCTS

# Higher-voltage systems can pay off for you as they did in these four buildings

Average electrical loads in commercial-type buildings have grown to equal many in industrial plants (approximately 10 volt-amperes per sq. ft.). With increased use of air conditioning, electronic equipment, appliances, and better lighting, loads will continue to grow.

**ARCHITECTS, CONSULTING ENGINEERS,** contractors, and building owners must provide first-class power distribution systems to meet today's demands and anticipate tomorrow's needs—yet keep costs within reason.

**ONE SOLUTION IS TO SELECT 480Y/277-volt** power systems when remodeling old or constructing new buildings. The success of the system in the four buildings illustrated is dramatically indicated by the large savings made in each case.

Comparable savings with this system exist when 33 to 50% of building load can be served direct from system voltage and when feeders average 200 feet in length. For detailed cost and savings information, use coupon on last page of this ad.

**SEE HOW THIS SYSTEM WORKS ►**

**GENERAL**  **ELECTRIC**

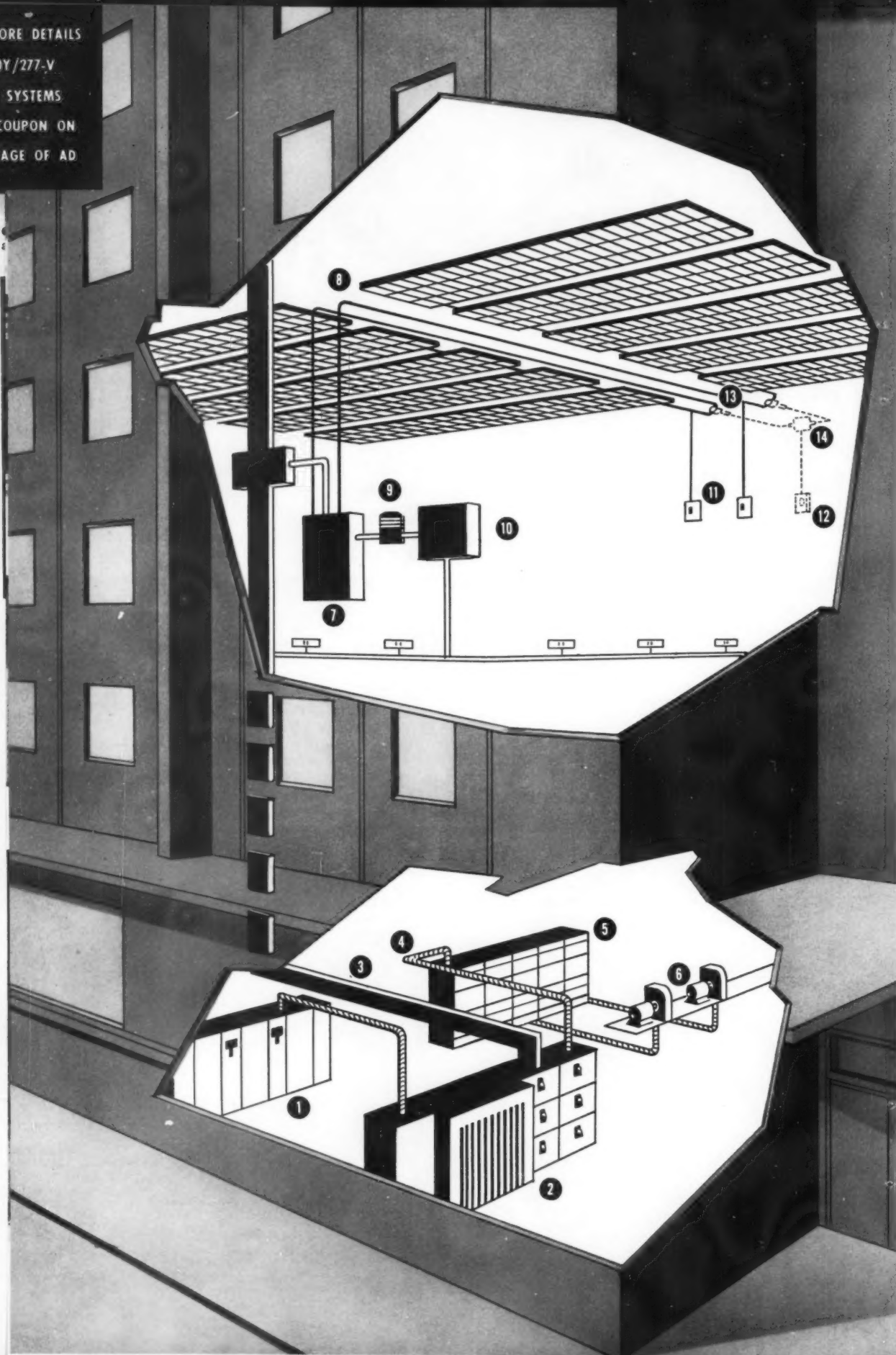
**\$50,000 SAVINGS** was the approximate, calculated dollar advantage that resulted from using the new system at the Prudential Insurance Co. North Central home office building, Minneapolis.

Rambling wings and 10-story tower makes system ideal for this structure. Magney Tusler & Setter, architects and engineers; C. F. Haglin & Sons, general contractors; Electric Repair & Construction Co. electrical contractors.





FOR MORE DETAILS  
ON 480Y/277-V  
POWER SYSTEMS  
MAIL COUPON ON  
LAST PAGE OF AD







**POWER  
DISTRIBUTION**

**SYSTEM  
PRODUCTS**

# G-E higher-voltage systems provide flexibility to meet future demand, use lower-rated equipment to supply larger loads

Because volumetric and floor space in commercial-type buildings is so valuable, substations usually must be located in basements and penthouses. This can mean long runs for secondary feeders. The greatest savings with higher-voltage distribution come from *halving* either the number and/or size of these feeders and their branch circuits.

**SAVINGS AS HIGH AS \$30 PER KVA** of demand can be obtained. Conductors carry two to four times the power they could at 120/208Y volts—meaning fewer and smaller circuits and great savings in copper throughout system. In addition, lower-rated and fewer circuit breakers are needed since lower-current distribution at higher voltage allows each breaker to serve more kva load. Motors above 500 hp cost less at 480 volts. Motor control at the higher voltage costs less for any motors. Higher-voltage distribution also

cuts feeder voltage drop, watt losses. Because less equipment and smaller equipment is needed, installation is easier, less expensive. Much valuable space is saved.

When time comes to expand capacity, original savings and advantages are repeated. More new equipment can be installed in space that would have been used initially with a 120/208Y-volt system. When modernizing old buildings it is often possible to *retain original conductors* and conduits, switch to higher voltage and increase capacity.

**120-VOLT POWER IS PROVIDED** by small low-cost transformers. Greatest savings occur when 277-volt lighting is used, *but* studies show big savings may still exist even if *all* lighting operates at 120 volts from small transformers. For full information on this economical, flexible system, send coupon on last page of this ad.

**SEE STANDARD EQUIPMENT FOR USE IN THIS SYSTEM ►**

**GENERAL  ELECTRIC**

## HERE'S HOW 480Y/277-V SYSTEM FITS A TYPICAL BUILDING

Cutaway shows components of higher-voltage system for building supplied with primary power by the utility.

Incoming power is brought through metal-clad switchgear (1) and distributed to unit substations (2) which step voltage down to required 480Y/277 volts. Busway or cable risers (3) carry power up to each floor while feeders (4) distribute it to motor control centers (5) for the air-conditioning, elevator and ventilating-fan motors (6).

On each floor power runs from risers to panelboards (7) supplying 277 volts for lighting (8). Circuit also runs from this panelboard to

small dry-type transformers (9) which furnishes power through a second panelboard (10) to the 120-volt floor circuits.

Lighting power may be safely controlled by conventional wall switches rated 20 amps, 277 volts (11) or by 24-volt remote-control switches (12). If remote control is used, relays (13) are required to accomplish switching and small transformers (14) to supply 24-volt power to remote-control switch for activating relays.

If secondary power (utilization voltage) is supplied by the utility, system begins at low-voltage switchgear section of substation.



FOR MORE DETAILS  
ON G-E EQUIPMENT  
FOR POWER SYSTEMS  
MAIL COUPON  
ON LAST PAGE  
OF AD



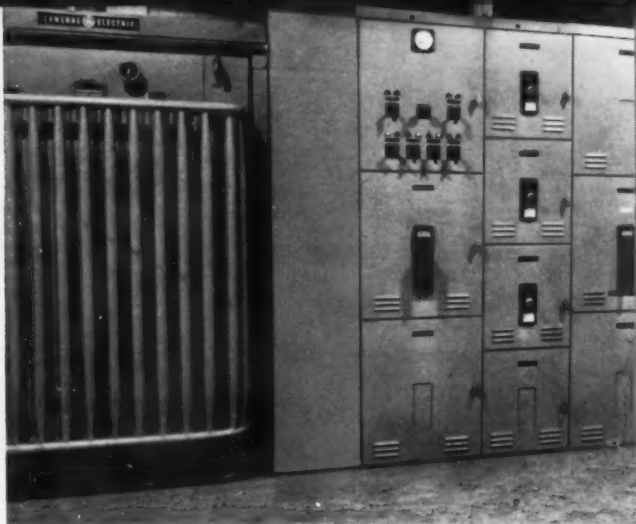
**RELIABLY GUARDING** system at entrance, G-E metal-clad switchgear is factory preassembled to save installation time. G-E magne-blast breakers are safer and easier to maintain.



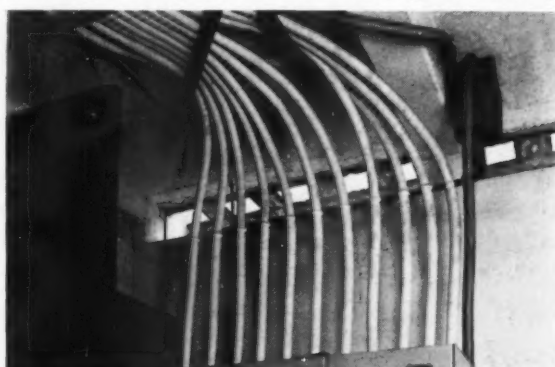
**COMPACT G-E** motor control centers place all control in easy reach and view of operator. Ready-to-install units are fully accessible to make connecting and servicing easier.



**SAFER, SURER PROTECTION** and control of 277-v circuits result with General Electric panelboards. Designed to take less space, they provide ample room for easy wiring.



**KEYSTONE OF SYSTEM**, General Electric unit substations dependably furnish power, close to load as possible, on well-protected circuits. They arrive at the site in integral units ready



**FASTER, LOWER-COST INSTALLATION** is possible with risers and feeders of G-E interlocked armor cable. Simple to install, it bends easily around obstructions, and needs no conduit.



**LOW-COST SOURCES OF 120-v power**, G-E dry-type transformers feature simple installation, quieter operation. They can be mounted almost anywhere, require little attention.



**QUICK, EASY WIRING** of G-E 120-volt panelboards is facilitated by roomy wiring gutters, all solderless connections. The 120-volt circuits serve portable machines and appliances.





**POWER  
DISTRIBUTION**

PRODUCTS

for quick installation. Compact and flexible, they fit into system wherever space is available, serve as "building blocks" for expansion.

**LOW-VOLTAGE-DROP** distribution is provided by risers and feeders of G-E Flex-A-Power\* busway. It assures most efficient service on long runs. Prefabricated sections and fittings provide easy, flexible installation.

\*Reg. trade-mark G.E. Co.

## Standard G-E products, available from single source, ease system planning, application, purchasing

General Electric offers all the needed electric equipment for any power distribution system. Packaged purchasing of all distribution equipment from one supplier assures smoother integration and performance of system. Design, accounting, and clerical work is saved by the convenience and efficiency of dealing with only one central source of equipment.

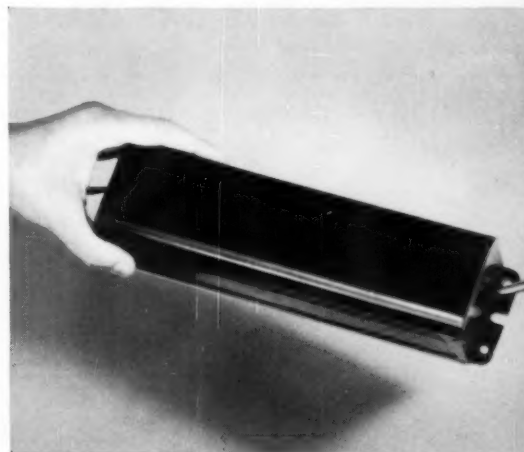
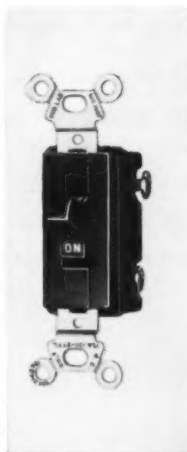
**G.E. CO-ORDINATES EQUIPMENT DELIVERY** with your construction schedules—no waiting for needed items nor storing of those shipped too early. Installation is speedier because factory assembling of

major equipment groups saves valuable time at site.

Uniform G-E equipment fits easily together into a highly dependable, attractive system because units are naturally designed to look better, work better together. Mail coupon on last page of this ad for more details on packaged vs. piecemeal systems.

**SEE ENGINEERING SERVICES AVAILABLE  
TO YOU WITH G-E EQUIPMENT** ►

**GENERAL  ELECTRIC**



**APPROVED SWITCHES** for 277-v lighting include new conventional snap switch (r) or remote-control switch (l), which uses small transformer to supply 24-v power to relay operating coils.

**AVAILABLE AT NO EXTRA COST** in larger lots of popular ratings, 265-v lamp ballasts serve lighting with longer, quieter operation, common to all G-E ballasts.



G-E ENGINEERING SERVICES . . .

# HELP PROTECT YOUR EQUIPMENT INVESTMENT



FROM PLANNING TO COMPLETION of building, General Electric engineers like Don Beeman (left) and Howard Kurt (right), both pioneers in development of 480Y/-277-v systems, help you select and apply the right equipment for efficient operation.

**1. APPLICATION ENGINEERING** helps architects and consulting engineers select and design the right electric system.

**2. ANALYTICAL ENGINEERING** helps design the optimum electrical system. Engineering experience, backed-up by electronic system analyzers save valuable design time.

**3. PRODUCT DEVELOPMENT** laboratories design and test new equipment under tomorrow's conditions to meet future demands.

**4. FIELD-SERVICE ENGINEERING** helps supervise installation, expedite start-up of major electric equipment.

**5. MAINTENANCE SERVICE** from 32 G-E Service Shops will repair and uprate old equipment, help establish productive maintenance of equipment, furnish emergency service.

**6. PROJECT CO-ORDINATION** means on-time engineering, shipment, installation of electric equipment from preliminary planning through start-up.

**G-E SERVICE CAN WORK FOR YOU** when you specify "G.E." equipment. Your G-E Apparatus Sales Representative can obtain any or all of the above services for you—contact him. For full story of the service available with G-E power distribution equipment, mail coupon below. General Electric Co., Section 680-1, Schenectady 5, N. Y.

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**MAIL TODAY for more information on modern power distribution systems**



GENERAL ELECTRIC CO.  
SECTION 680-1, SCHENECTADY 5, N. Y.

Please send me:

- ☐ your basic brochure, "Modern Power Distribution Planning Guide" (GEA-6344).  
☐ I am especially interested in power distribution for buildings within secondary network areas, so include "Modern Distribution Equipment for Commercial Buildings in Secondary Network Areas" (GEA-6223).

NAME \_\_\_\_\_

POSITION \_\_\_\_\_ COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_





This electrical surge test is one of the 258 tests that every G-E ballast receives during the manufacturing cycle. This test subjects G-E ballasts

to the most severe conditions they will ever encounter in actual operation; assuring you of long ballast life and low lighting costs.

**Flora\* shows you why . . .**

## Superior Quality Control of G-E Ballasts Helps You Save Lighting Dollars

Lighting engineers, designers, and users have learned to depend upon the consistently high quality of General Electric fluorescent lamp ballasts.

They know that the rigid material specifications and constant production line tests mean uniformly good ballasts; save lighting dollars by minimizing early replacement and maintenance costs.

Starting with raw steel and copper wire at the receiving dock and ending

only when the finished ballast is loaded for shipment, G-E quality control engineers constantly test raw material and ballast parts to meet rigid mechanical and electrical requirements.

By actual count a G-E ballast receives 258 different tests and checks before packing and shipment! This painstaking care pays off to you in highly dependable operation, efficient lamp output, and long ballast life—it saves you valuable lighting dollars.

Next time you specify equipment for a fluorescent lighting installation, make sure you get the best...specify General Electric quality-controlled ballasts.

A G-E ballast tag or sticker on your fixture is proof that it's equipped with the best in ballast value. It's the easy way to be certain. For further information on G-E ballasts, write Section 401-9, General Electric Company, Schenectady 5, New York.

\*Miss Fluorescent Ballast, G. E.'s Ballast Mascot  
Copyright 1955, General Electric Company



CLOSE INSPECTION of each component assures you of high quality ballasts, lower lighting costs and dependable performance.

### Five more reasons why

GENERAL ELECTRIC IS YOUR BEST BALLAST VALUE

- EXCLUSIVE SOUND RATING SYSTEM
- LONGER BALLAST LIFE
- PRECISE LAMP-MATCHED DESIGN
- PROVED PRODUCT LEADERSHIP
- COMPLETE CUSTOMER SERVICES

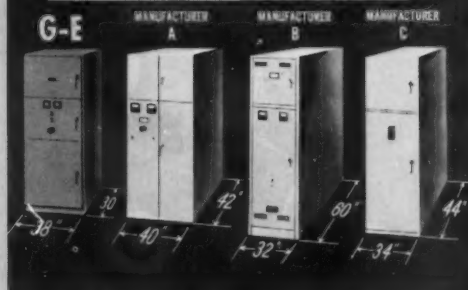


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**NEW G-E LIMITAMP CONTROLLER FLOOR SPACE  
COMPARISON WITH OTHER MANUFACTURERS**



356 SQ. IN. LESS area than next smallest starter.

General Electric Announces . . .

## NEW Limitamp\*

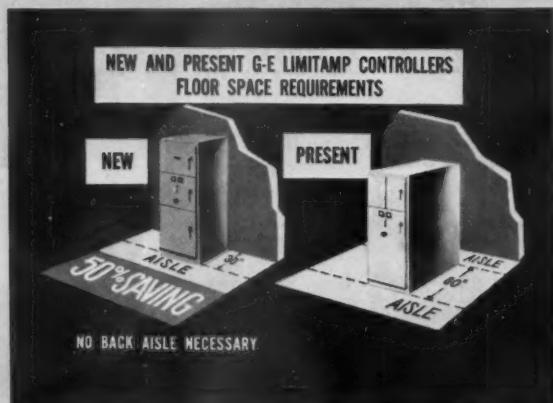
- Gang-operated disconnect switch on all units
- Entirely front connected
- 30-inch depth
- Low-voltage panel hinged to swing out of enclosure
- Contactor rolls in or out of cabinet

### NEW DESIGN

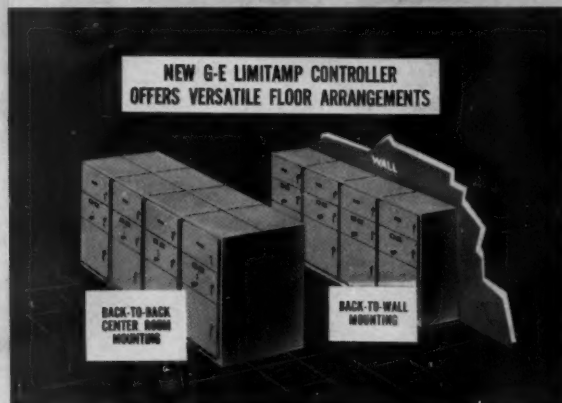
**INSTALLATION IS SIMPLIFIED.** A man can easily enter enclosure to make connections.







OVER 50% SPACE SAVINGS by elimination of back-aisle.



VERSATILE INSTALLATION—units all front connected.

## Control saves over 50% floor space

**ENTIRELY FRONT CONNECTED.** only 30 inches deep, General Electric's all-new Limitamp control offers versatility of installation. New 30-inch depth allows unit to be transported through normal size doorways, and 90-inch height includes bus compartment. Back-to-back, back-to-wall, or mounting as free standing enclosure is now possible.

**IDEAL FOR HIGH-VOLTAGE MOTORS,** rated 2300-4800 volts and up to 3000 h-p, the new Limitamp control may be applied to squirrel-cage, synchronous, wound-rotor, and multi-speed motors on power systems requiring high interrupting capacity for maximum short-circuit protection.

**NEW CONCEPTS IN SAFETY** are built into new Limit-

\*Trade-mark of General Electric Company

amp control. Gang-operated disconnect switch, steel barriers between all compartments, enclosed bus compartment and co-ordination of starter assure you of safer high-voltage motor control.

**G.E. LIMITAMP STARTERS** are co-ordinated to provide maximum protection for equipment and personnel. Co-ordinated circuit components guard against needless fuse blowing, give running overload protection and provide maximum safe-guard against short-circuit damage for starter and equipment.

**FOR COMPLETE APPLICATION ENGINEERING** service contact your nearest G-E Apparatus Sales office. Write for Bulletin GEA-6331, Section 781-12, General Electric Co., Schenectady 5, New York.

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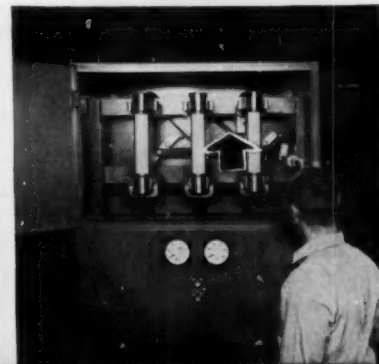
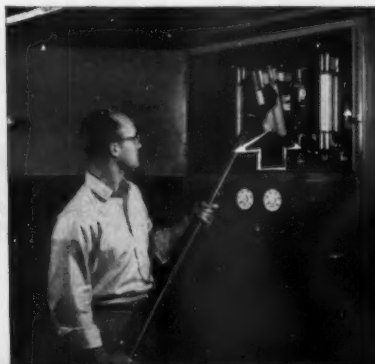
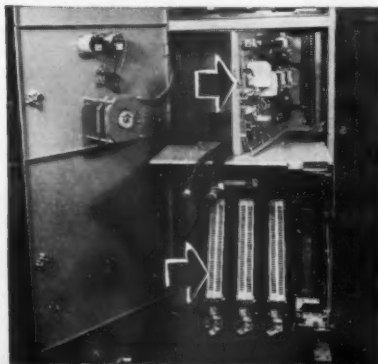
**GENERAL  ELECTRIC**

## SIMPLIFIES INSTALLATION AND MAINTENANCE

**MAINTENANCE IS EASY.** Low-voltage panel swings out, contactor rolls out.

**TYPE EJ-2 CURRENT-LIMITING** fuses are safely, quickly replaced within seconds.

**SAFE VISUAL CHECK** of disconnect switch with fuse compartment door open.



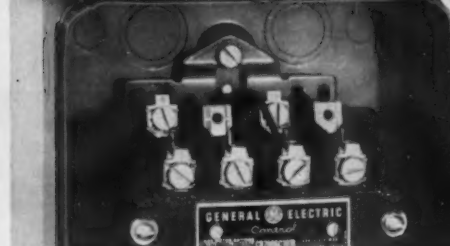




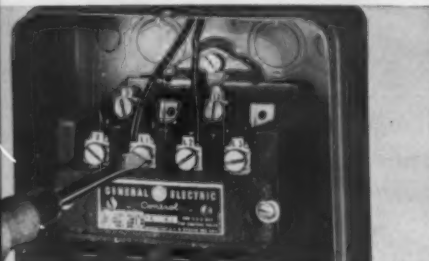
**1 KEYHOLE MOUNTING** of starter. Slide openings over three screws. Starter is supported while tightening. Enclosure has similar type mounting.



**2 10 COMBINATION KNOCKOUTS** on top, bottom, sides and back. You can use the most direct wiring, and easily adapt starter for all your applications.



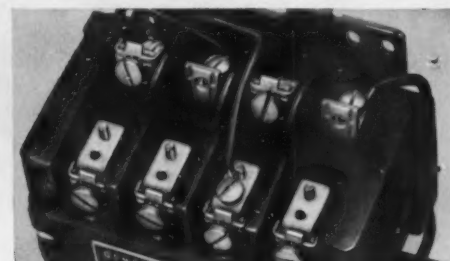
**3 WIRING ROOM** is plentiful when starter is mounted in enclosure. Laying wire to terminals and cutting to length are simplified by ample space.



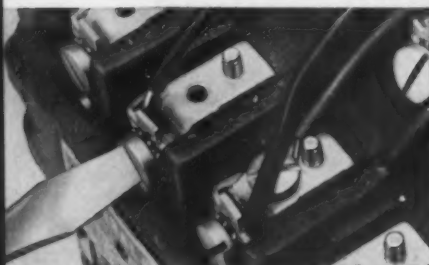
**4 FRONT-CONNECTED WIRING** means all the connections are made after starter is mounted. Terminals are right in front where they are easily reached.



**5 IDENTIFIED TERMINALS** clearly show wiring for the power and load. There is no guessing where a wire is to go, and incorrect wiring is reduced.



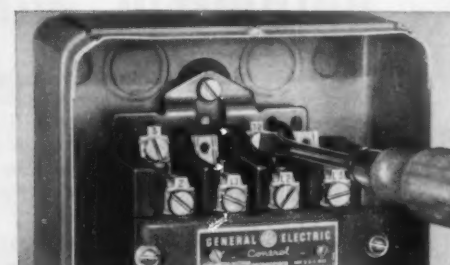
**6 SEPARATE CUSTOMER TERMINALS** mean no factory leads to slip out or take space you need. All the factory wiring goes to separate terminals.



**7 CLAMP-TYPE TERMINALS** make wiring easy. When terminal screw is backed out, clamp follows. Hold stripped wire behind clamp when tightening.



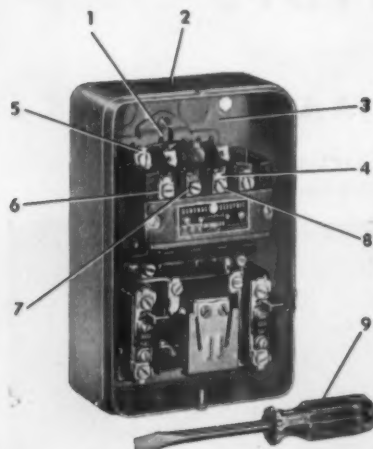
**8 PAN-HEAD SCREWS** have large, deep slots to take full width of screwdriver to help prevent slippage. Hardened head helps prevent burring.



**9 SCREWDRIVER GOES STRAIGHT IN** to all the terminals—nothing is in the way. And, a screwdriver is the only tool that is required for installation.

## 9 FEATURES of G-E Magnetic Starters to . . .

# SPEED INSTALLATION—REDUCE COSTS



When you install G-E magnetic starters, you can speed installation, and reduce your costs for greater profits. Nine starter features save you money, yet your customers get the customer-proved dependability of G-E magnetic starters. Take advantage of these nine features for speedier installation on your next job.

Write Section 733-1, General Electric Company, Box 913, Bloomington, Illinois, for bulletin:

GEA-6198 Magnetic Starters

GEA-6322 New Size 4 Magnetic Starter

For further information, contact your G-E Distributor.

# GENERAL ELECTRIC





*You get modern, on-the-job efficiency  
from fluorescent installations equipped with*

## **CERTIFIED CBM BALLASTS**

Everyone—the architect, fluorescent fixture manufacturer, distributor, electrical contractor and the ultimate user—wants fluorescent lighting installations to give satisfactory performance.

The easiest way to be certain of getting top efficiency is to insist that all fluorescent fixtures are equipped with CERTIFIED CBM BALLASTS.

Manufacturers of fluorescent tubes, who know how important ballasts are to the proper operation of their lamps, recommend and endorse the use of CERTIFIED CBM BALLASTS.

CERTIFIED CBM BALLASTS assure:

**RATED LAMP LIFE • FULL LIGHT OUTPUT • LONG BALLAST LIFE • QUIET, TROUBLE-FREE OPERATION**

Eight of the country's leading manufacturers of ballasts make CERTIFIED CBM BALLASTS. Participation in CBM is open to any Manufacturer who wishes to qualify.

Send for free new booklet, "Why It Pays to Use CERTIFIED CBM BALLASTS in Fluorescent Lighting Fixtures".



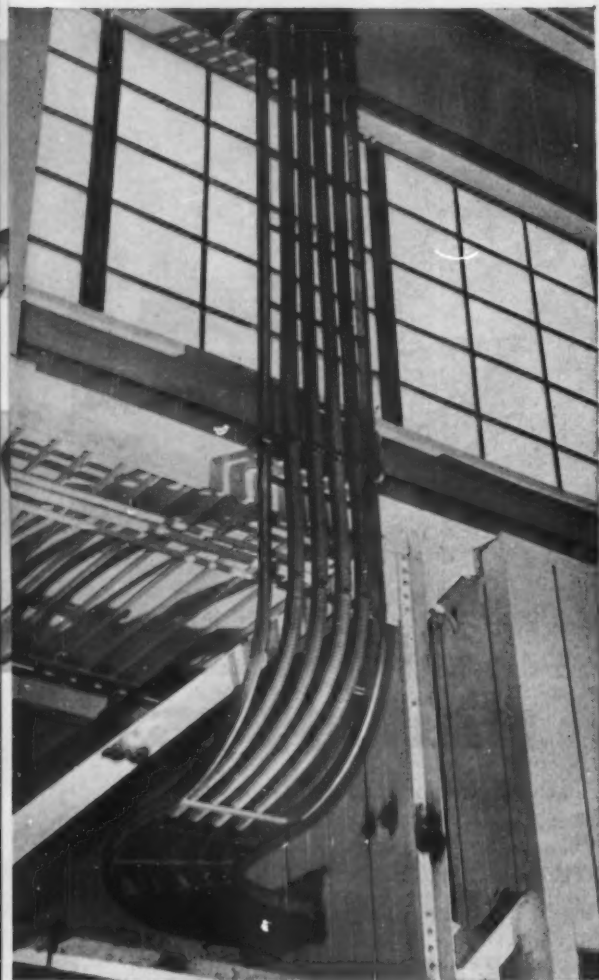
## **CERTIFIED BALLAST MANUFACTURERS**

*Makers of Certified Ballasts for Fluorescent Lighting*

**2116 KEITH BLDG., CLEVELAND 15, OHIO**



# 7 ways new developments in wires wiring "modernization" business



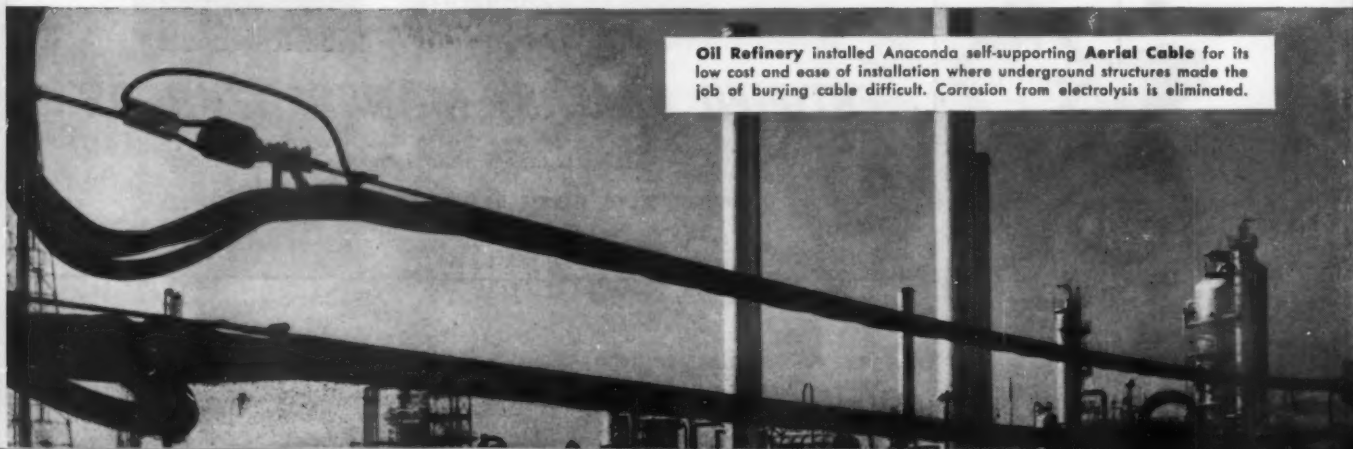
Assembly plant reaped high-cost savings by installing flexible, quickly placed Anaconda **Interlocked-Armor Cable** from unit substation.

Plant wiring can be adequate and still be costly — because it is obsolete. This is a second phase of "adequate wiring" that is becoming of more and more concern to profit-squeezed management—and a new source of business for contractors—every day.

Since most plants were built—including some only a few years old—vast advancements in wires and power cables have taken place.

Let's take a look at 7 of the most important of these in light of changes that have taken place in the plants themselves, in most cases, since the original wiring was installed.

- 1. NEW HIGHER VOLTAGES.** The trend to higher plant voltages—with its resulting savings in cable costs and line losses—poses a new problem: ozone, a by-product of high voltage, destroys ordinary insulation . . . and causes premature cable failure. Anaconda engineers have solved this problem with pioneering work in new *butyl* rubber. Anaconda AB butyl-insulated high-voltage cables have *inherent* resistance to ozone.
- 2. NEW CABLE HAZARDS.** Chemicals, moisture, oil—natural to most modern plants—are tough on cable. Engineers at Anaconda have come up with an answer: Durasheath\* rubber-insulated, neoprene-jacketed cable for all voltages. This rugged cable resists almost *every* enemy of cable life. Suggest its use everywhere—aerially, in ducts, or buried directly in the ground. It reduces down-time, maintenance and replacement costs.
- 3. NEW OPERATING CONDITIONS** put a new demand upon wiring. Higher loads generate higher heat in cable . . .



**Oil Refinery** installed Anaconda self-supporting **Aerial Cable** for its low cost and ease of installation where underground structures made the job of burying cable difficult. Corrosion from electrolysis is eliminated.



# and cables build for contractors

and more heat in cable installed underground or in other moist locations is tough on cable insulation. Today, AHW rubber insulation, used on many Anaconda rubber power cables, does the best job ever in withstanding *heat and moisture together*.

**4. NEW EQUIPMENT.** The addition of process-heating equipment, process or comfort air conditioning, or new production machines calls for more wiring to carry the load. Anaconda Interlocked-Armor Cable can be installed quicker than many other types of cable because it needs no conduit. Plant saves time and money when the cable is installed—and later, too, if cable must be moved.

**5. MODERN BUSWAY SYSTEMS.** Today you can increase the flexibility of busways—with Anaconda's flexible Powerduct\* Cable. It just plugs into the busduct . . . and unplugs when management wants to move machines. There's no costly conduit to put up or rip out. And the cable is 100% salvageable on every move!

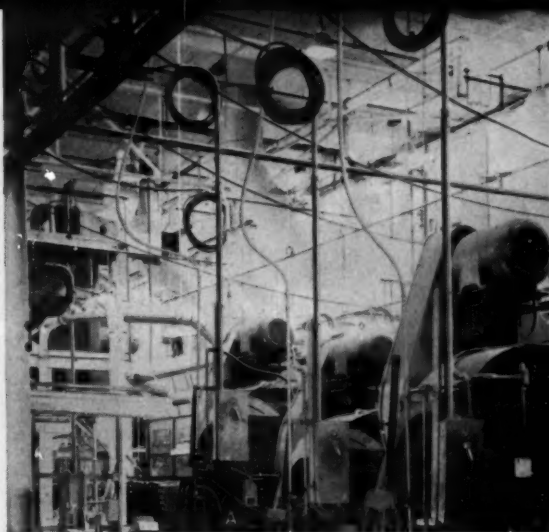
**6. NEW POWER.** When additional power is needed, Anaconda Aerial Cable is today's popular choice for the job, especially where the ground is packed with pipes and other structures or contains corrosive agents. It is fast, easy to install even between closely spaced buildings where clearance is limited. It's neat, safe, lower in cost than underground systems, and gives highest *reliability*.

**7. NEW ELECTRIC EQUIPMENT.** The trend to automation and more complex machines puts new emphasis on control cable. The job cannot be left up to cable whose performance is just "so-so." Anaconda's years of cable experience have paid off in a new full line of control cables—with modern types of insulations and coverings to give them highest reliability.

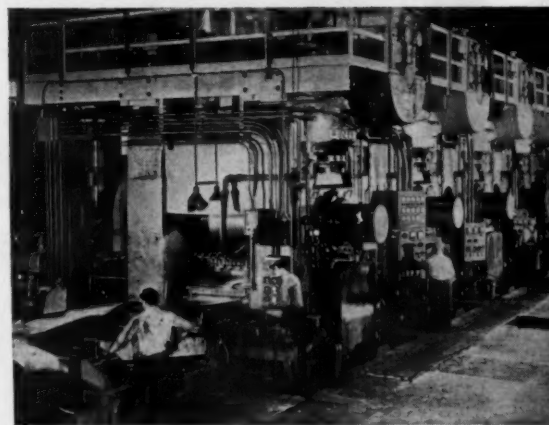
This advertisement provides only a few examples of how modern Anaconda wires and cables can help you help industry in your area wire up for more economical, more efficient production. For more information, see the Man from Anaconda. Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.

\*Reg. U. S. Pat. Off.

# ANACONDA®

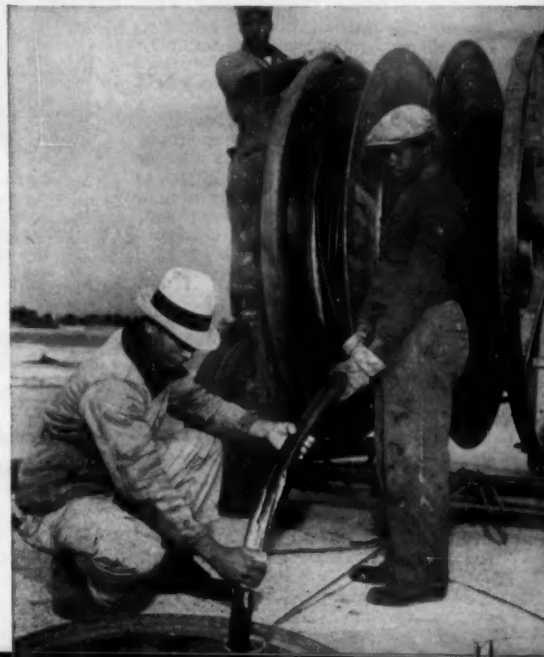


**Metalworking plant** eliminates expensive rewiring when equipment must be moved—by using flexible Anaconda **Powerduct Cable** from busduct to machine.



**Steel Mill** uses thousands of feet of Anaconda **Control Cable**. Modern insulations and jackets give most reliable service everywhere there's heat and moisture.

**Chemical plant** installed thousands of feet of Anaconda **Dura-sheath Cable** for power and lighting. Rugged neoprene jacket resists heat, moisture, acids and alkalis.





# NEW

## WESTON miniature clamp Volt-Ammeter



with  
shock-mounted  
core magnet mechanism!

Lightweight and really pocket size... yet this instrument packs new ruggedness and dependable accuracy. Employs CORMAG® self-shielded mechanism with spring-backed jewels, which is shock-mounted in the sturdy Bakelite case. Window, too, is of shatterproof Plexiglas, wrap-around design. Only one easily read scale for all ranges and functions. Jaws take up to 1" round, or 1 1/4" rectangular conductors. Ranges—Current: 300/150/60/30/15/6 amperes a-c—Voltage: 600/300/150 volts a-c. At local distributors or write — WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey.



Supplied in this sturdy, scuff-proof case with compartment for voltage test leads.

### WESTON

*Instruments*

# VALUE LEADER

28 functional ranges for  
wide measurement needs



only \$42.50

## WESTON (Model 980) VOLT-OHM-MILLIAMMETER

...the biggest value ever offered in test equipment...ideal for production testing, maintenance and trouble shooting, and all-round measurement needs. Broad range coverage as follows:

D-C Volts: 1.6, 8, 40, 160, 400, 1600 (20,000 Ohms/Volt)  
A-C Volts: 1.6, 8, 40, 160, 400, 1600 (1,000 Ohms/Volt)  
DB Range: -15 db to +54 db (in six ranges)

D-C Microamperes: 80  
D-C Milliampers: 8, 80, 800  
D-C Amperes: 8

OHMS RANGE	CENTER SCALE	FULL SCALE
R x 1	25	1,000
R x 10	250	10,000
R x 100	2,500	100,000
R x 1,000	25,000	1 megohm
R x 10,000	250,000	10 megohms

Accuracy 2% d-c, 3% a-c  
Scale length 4.63" — size 6 1/4" x 7 1/2" x 3 1/4"  
Weight 2 lbs., 11 oz.

For descriptive bulletin, write WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, N. J.

At leading  
Distributors

### WESTON

*Instruments*

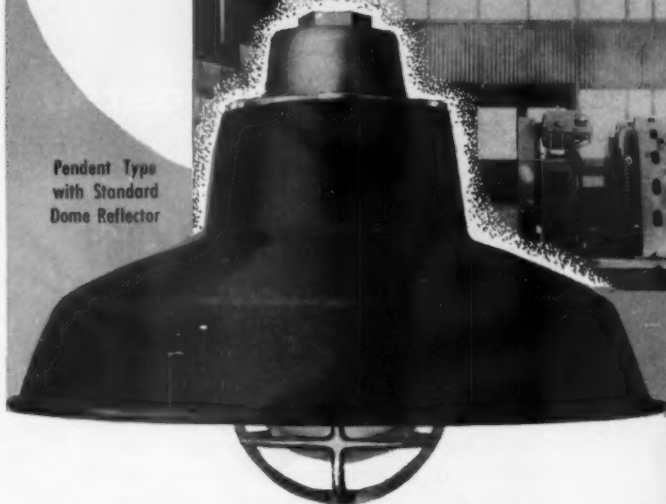


**R&S**

# VAPORTIGHT

## Lighting Fixtures

Pendent Type  
with Standard  
Dome Reflector



...maximum protection  
and lighting efficiency for  
wet and corrosive locations

For outstanding vaportight and raintight protection, specify R&S Vaportight lighting fixtures. They're designed for outdoor or indoor use, wherever moisture, vapors, smoke, non-hazardous gases or corrosive atmospheres are present. Outdoor locations include: docks, loading platforms, airports, underpasses, bridges, building entrances, and many others. Indoor applications range from cold storage plants, breweries, dairies, boiler rooms, power houses, tunnels, to shower rooms and bathhouses.

The simplified design of these quality fixtures assures superior illumination with minimum installation, service and operating expense. The fixtures are available in a wide range of ceiling, pendent and bracket types — in 15 watt through 500 watt sizes. Bases have wiring chambers that stay vaportight even when globes are removed or broken. All guards and globes are interchangeable in their respective sizes.

WRITE FOR BULLETIN 2A - 4

**R&S also makes Explosion-Proof, Dust-Tight and Marine Lighting Fixtures and Fittings**  
**A Complete Line for Every Lighting Need**



Pendent Type without  
reflector



Ceiling Type with Shallow  
Dome reflector



Bracket Type without  
reflector



Pendent Type with 30°  
Angle reflector

RUSSELL & STOLL COMPANY, INC. • 125 BARCLAY STREET, NEW YORK 7, N.Y. D. 20

# RUSSELL & STOLL

PRECISION-BUILT ELECTRICAL EQUIPMENT—SINCE 1907



# ROECLAD PORTABLE POWER CABLES

**TYPE G ROECLAD CABLE**  
— with ground wires —  
for service to 5000 volts.

**TYPE W ROECLAD CABLE**  
— without ground wires  
— for service to 2500  
volts.

**TYPE SH-A, B, C or D ROECLAD CABLE** — shielded,  
with or without ground  
wires — for voltages  
above 2500 — made in  
four different applica-  
tions of shielding and  
ground wires.

## YOU WANT

- RUGGEDNESS — FOR MAXIMUM LIFE  
IN TRANSMITTING POWER TO MOBILE  
EQUIPMENT UNDER TOUGHEST CONDITIONS;
- CABLES THAT ARE TAILOR-MADE  
FOR YOUR OWN PARTICULAR REQUIREMENTS;  
IN SHORT,

**YOU WANT**

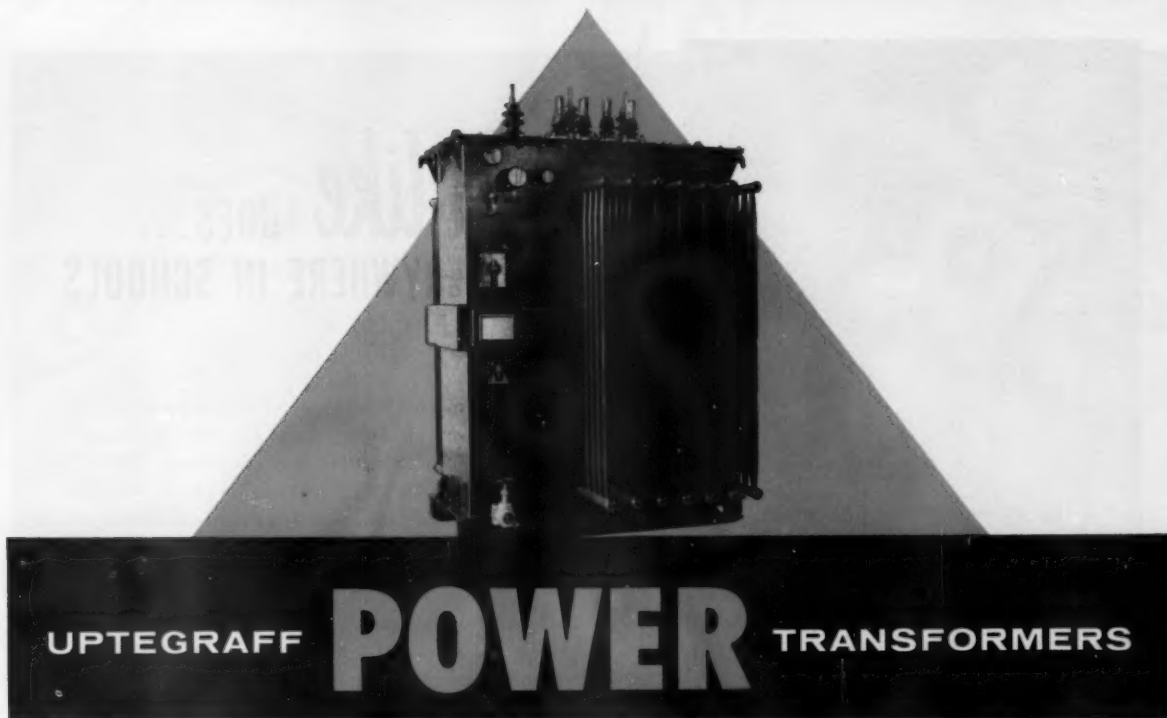
# ROEBLING

*Subsidiary of The Colorado Fuel and Iron Corporation*

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 11-15 STILLING ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13235 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 5216 NAVIGATION BLVD. • LOS ANGELES, 5348 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1930 E. 2ND ST. • PHILADELPHIA, 330 VINE ST. • PITTSBURGH, 1733 HENRY W. OLIVER BLDG. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 331 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.







# UPTEGRAFF POWER TRANSFORMERS

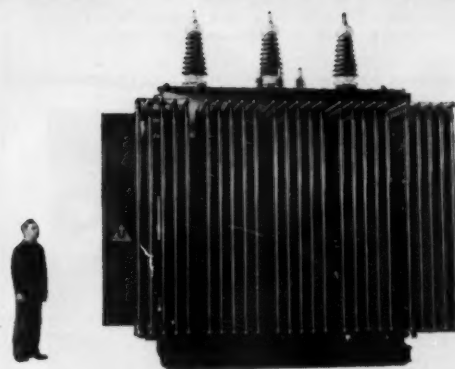
## PROMPT DELIVERY... FULLY GUARANTEED

A complete engineering department and a modern, fully-equipped plant give Uptegraff the facilities it takes to provide fast service on power transformer production—even those of special design.

Available in sizes up to 10,000 KVA, 115 KV, every Uptegraff transformer meets or exceeds ASA, NEMA and AIEE standards and is fully guaranteed by our company.

These two advantages are yours when you order Uptegraff transformers for your power needs. And when the unit is delivered and installed, you have one of the finest built pieces of electrical equipment in the country—rugged, leakproof, undercoated, and performance tested.

You can order Uptegraff Power Transformers with standard accessories; terminal arrangement,

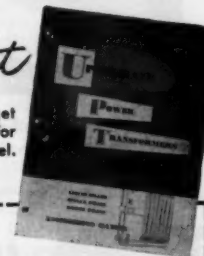


cooling fans, wheels, oversize bushings and many other special accessories are optional.

If you're getting ready to replace or add to your transformer installations, Uptegraff can serve you well and quickly.

*Send for Data Booklet*

Use coupon below or your letterhead and get this comprehensive **ENGINEERING MANUAL** for executives, engineering and operating personnel.



R. E. UPTEGRAFF MANUFACTURING CO.  
Scottsdale, Pa.

Name

Address

City  State

ECM





Corridor in the Whiting Lane School, West Hartford, Conn. Moore and Salsbury, Architects.

# Skylike GOES... EVERYWHERE IN SCHOOLS

Skylike, the silvered bowl incandescent modular unit has been accorded wide acceptance as a highly efficient and economical indirect lighting unit for schools. The 24" and 14" units with metal eggcrate or plastic diffusers provide the quality and quantity of light demanded for school requirements—in classrooms, auditoriums, corridors, gyms, lunchrooms, etc.

Exclusive features include comfortable low brightness, pleasing color, floor relamping, minimum of maintenance and comparatively low initial cost. For any school lighting problem it will pay you to investigate the many advantages of Skylike.



Classroom in the Whiting Lane School, West Hartford, Conn. Moore and Salsbury, Architects.



Band Room in the Concord, North Carolina, City School. A. G. Odell, Architect.



## FOR COMPLETE DETAILS

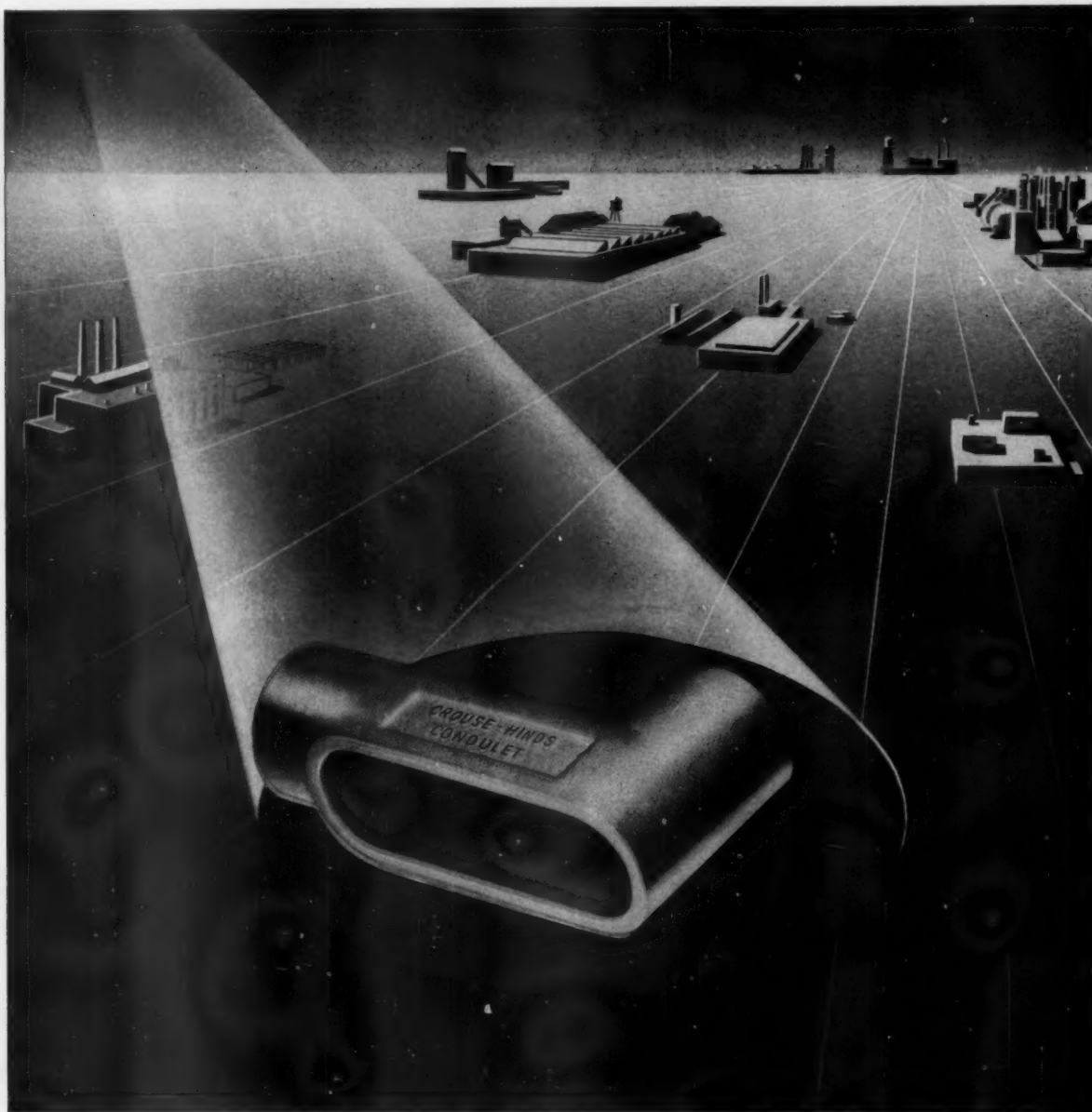
A new 12 page brochure which provides complete data on Skylike is available to school officials, architects, engineers and contractors upon request.

## SKYLIKE LIGHTING, INC.

A SILVRAY ASSOCIATED COMPANY

RKO Bldg., New York • Bound Brook, New Jersey





## *Still the standard of quality in rigid conduit fittings*

Condulets\* have been widely imitated since Crouse-Hinds introduced them more than 40 years ago . . . *and that's all to the good!*

Imitation by others has kept us on our toes . . . made us constantly improve our product to stay *ahead* of competition.

As a result, most conduit fittings today incorporate many basic features pioneered by Crouse-Hinds—but lack certain refinements that

put Condulets in a class by themselves, head and shoulders above the rest.

What other fittings, for example, include these improvements:

. . . an ingenious *Cover* design that eliminates protruding screws or ears in the housing—common causes of cable damage.

. . . a longer *Hub* that permits full tightening of conduit and fitting without causing conduit to bottom on the integral bushing.

. . . a corrosion-resistant Feraloy *Body* plus a triple-layer *Finish* that exceeds Federal and UL specs. for lasting protection.

These years-ahead Condulet features have yet to be equalled. You get them in all 45 types of Obround Condulets ranging in size from  $\frac{1}{2}$ " to 6". See your Crouse-Hinds distributor. Crouse-Hinds Company, Syracuse 1, New York.



**CROUSE-HINDS COMPANY**

CONDULETS

FLOODLIGHTS

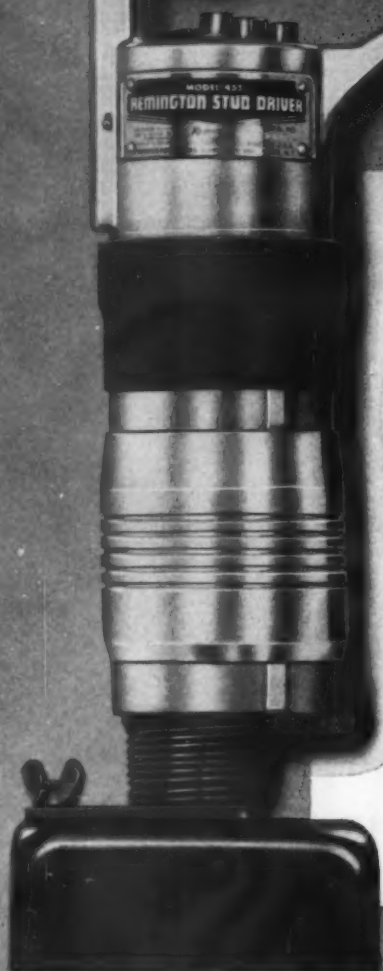
TRAFFIC SIGNALS

AIRPORT LIGHTING

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . OCTOBER, 1955



# NEW



## Interchangeable barrels for $\frac{1}{4}$ " and $\frac{3}{8}$ " studs



Operator can change from one barrel to the other in seconds, right on the job! No time lost in going from medium- to heavy-duty work—no need for second tool!



## A squeeze of the trigger and the job is done!



Anchoring wood furring to steel . . . steel angle to concrete

Compact tool can be used overhead, in tight places—anywhere a man can go. No outside power source required!



**tool cuts costs on all stud  
fastening jobs!**

*with the*

# *Double-Duty* **REMINGTON STUD DRIVER**

**You can anchor both  $\frac{1}{4}$ " and  $\frac{3}{8}$ " studs  
in steel or concrete... instantly!**

Here's the first cartridge-powered tool that can cut your costs on practically all construction fastening—light, medium and heavy duty. It's the new Model 455 Remington Stud Driver!

The secret of this amazing versatility lies in the tool's construction. Two sizes of studs can be used— $\frac{1}{4}$ " and  $\frac{3}{8}$ ". Changeover in barrels takes only 90 seconds *right on the job*. With either size, an operator can set up to 6 studs per minute... anchor conduit clips, wood sections, steel frames and many more fixtures with a squeeze of the trigger!

What powers the Stud Driver? Remington 22 and 32 caliber cartridges for the  $\frac{1}{4}$ " and  $\frac{3}{8}$ " studs respectively. For special medium-duty applications, the smaller cartridge may be used with the larger

stud, giving an extra-strong fastening at a saving. Every stud is driven arrow-straight, whatever the combination.

**GET ALL THE FACTS** about this new, useful fastening tool that goes anywhere, works anywhere—without wires or cables, hammering or predrilling. The Model 455 Remington Stud Driver makes the toughest fastening job a one-man, one-tool job and saves you time and money with every application! Just clip the coupon below for full details.

**MAIL THIS COUPON TODAY!**

Industrial Sales Division  
Remington Arms Co., Inc., Bridgeport 2, Conn.

Please send me your free booklet which shows where and how to use the cost-saving Remington Stud Driver fastening method.

Name \_\_\_\_\_ Position \_\_\_\_\_

Firm \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

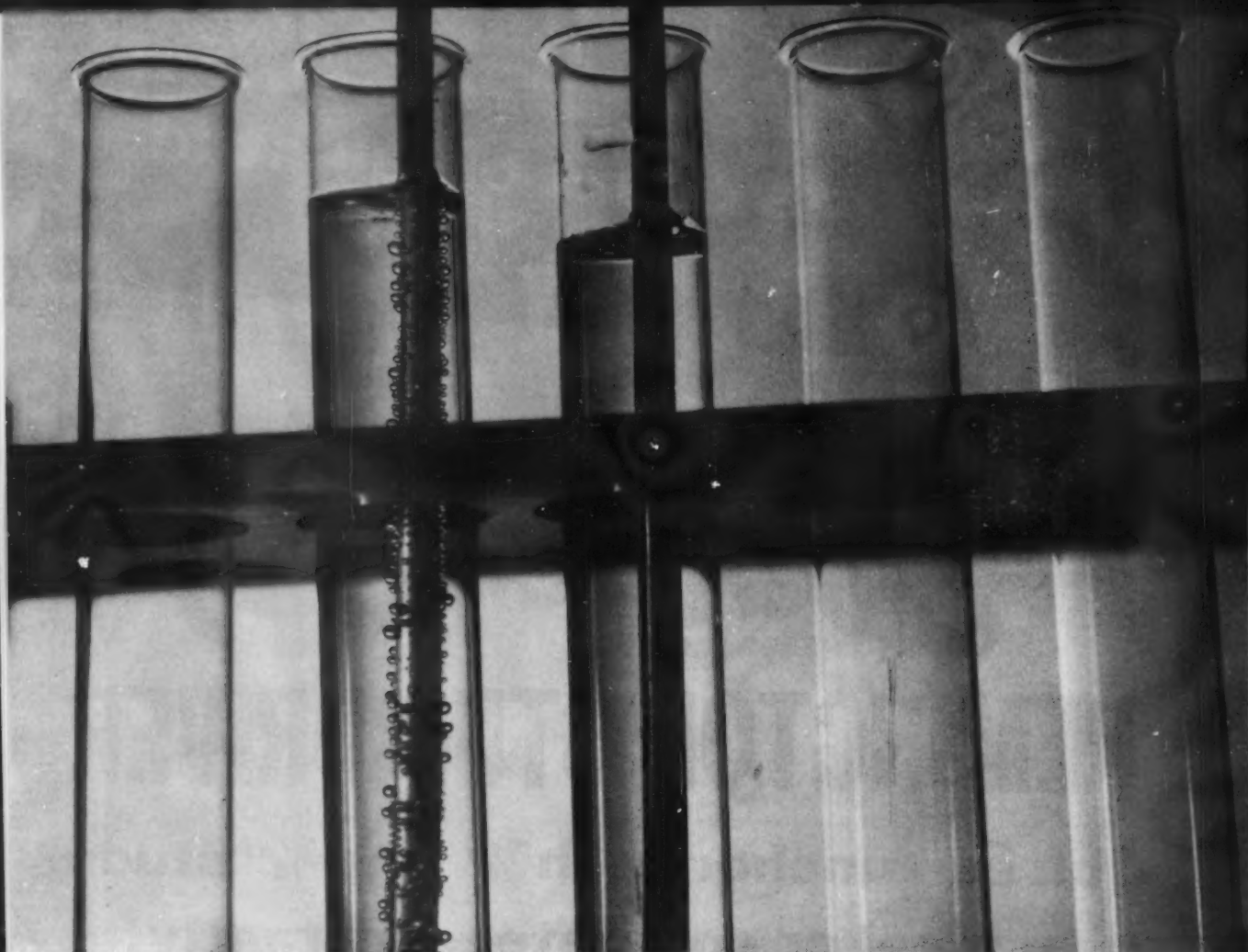
E.C.M.-10

*"If It's Remington—It's Right!"*

**Remington** 







## Why Okoloy conductor coating outlasts "tinning" 2 to 1

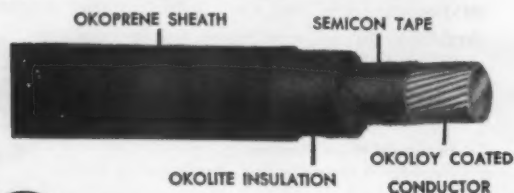
The conductors above are immersed in a solution of sulphuric acid. Bare copper conductors are quickly attacked by corrosive chemicals such as sulphur acids formed when moisture combines with sulphur and sulphur compounds frequently used in the vulcanization of rubber insulations. The conductor coating must, therefore, be highly resistant to it.

The copper wire on the left is coated with tin, the most commonly-used conductor coating material. The acid attacks it immediately. The other copper wire, unaffected by the acid, is coated with Okoloy. Okoloy, a virtually pure lead coating, has been used by Okonite since 1928 to coat all copper conductors for rubber-insulated cables. Of all the common metals, lead is least affected by sulphuric acid and other corrosive chemicals. *Okoloy outlasts even the best "tinning" at least 2 to 1.*

\* \* \*

Next time you buy a rubber-insulated cable, *make sure* the insulation and conductor are protected by Okoloy conductor coating—not tin.

The Okonite Company, Passaic, N. J.



Okolite-Okoprene cables are made by the strip-insulating process

# OKONITE



# insulated cables



# AN INDUSTRIAL SO REVOLUTIONARY IT CUTS INSTALLATION COSTS 50%

**GIBSON**

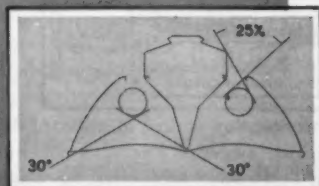
**ortho-88®**

Patent Applied for

Continuous Uni-Race section provides exact fixture spacing, 100% alignment, and fixed power source for each unit.



Note outlet into which fixture automatically seats when closed. In this position the lighting unit is dead.



Self-cleaning. 83.5% efficiency. 25% cp light. 30° shielding.

- SAVES ON CONDUIT, RECEPTACLES, ACCESSORIES
- ELIMINATES ALIGNING EXTRAS, Y CHAINS, CORDS AND PLUGS

The exclusive features of the Gibson Ortho-88 make it possible to enjoy superior industrial lighting at the cost of ordinary installations.

The Uni-Race, to which units are later attached, is easily assembled into sections up to 24 feet long and wired completely *on the floor*, except for final service connection. It is raised and hung as a unit—directly to bar joists, beams or stems. Alignment and spacing for fixtures is automatic.

The Uni-Race provides power for temporary lighting and tools. When the building is ready for occupancy, spotless fixtures can be snapped into place by two men, without tools, at the rate of 45 to 55 units per hour—in continuous rows or at intervals of 4, 8, 12 or more feet. Spacing can be changed, more units added, repairs made—all without interrupting service to other fixtures on the circuit, or additional electrical work.

The result is a top-quality installation with savings on materials and labor up to 50%.

Get all the facts in our Ortho-88 bulletin, which we'll gladly send on request, and you'll see why it pays to use the Ortho-88.



**GIBSON**

*Manufacturing Co.*

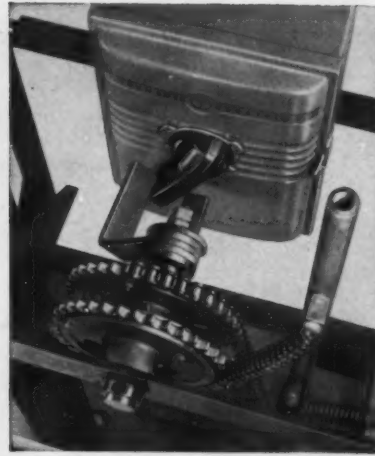
1919 Piedmont Circle, N.E., Atlanta 21, Georgia



# Two new tests prove G-E heavy duty HCI safety switches give you 66% safety margin



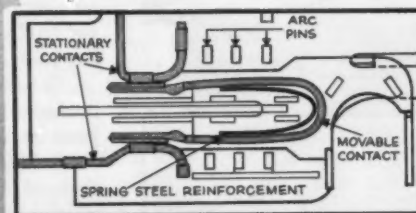
**1** Normal U/L and NEMA tests call for a switch to operate at 6 times the motor full load current, the same current a locked rotor will create. G.E. tested its 30 amp heavy duty HCI switches and found that they would successfully operate at 10 times full load current—a safety margin of 66%!



**2** The same switches were then tested for 6,000 times at rated load and 44,000 times at no load, five times the normal U/L requirement. These tests indicate that G-E's heavy duty switches give you many "bonus years" of reliable service because of sturdy mechanical and electrical construction.



For general circuit protection at lower cost, the standard duty switch retains many heavy duty features. Pole units can be individually replaced, reducing maintenance costs. Straight-in wiring, removable interior and plenty of working room make installation simple and quick. Front fusing makes fuse replacement easy.



**HCI arc interruption** is used in standard duty and heavy duty switches. Exclusive pole units give double-break action, reduce arcing. Unique arc-quenching pins quickly snuff out arc. Quick-make, quick-break action helps prevent burning; operator can't tease in or out.



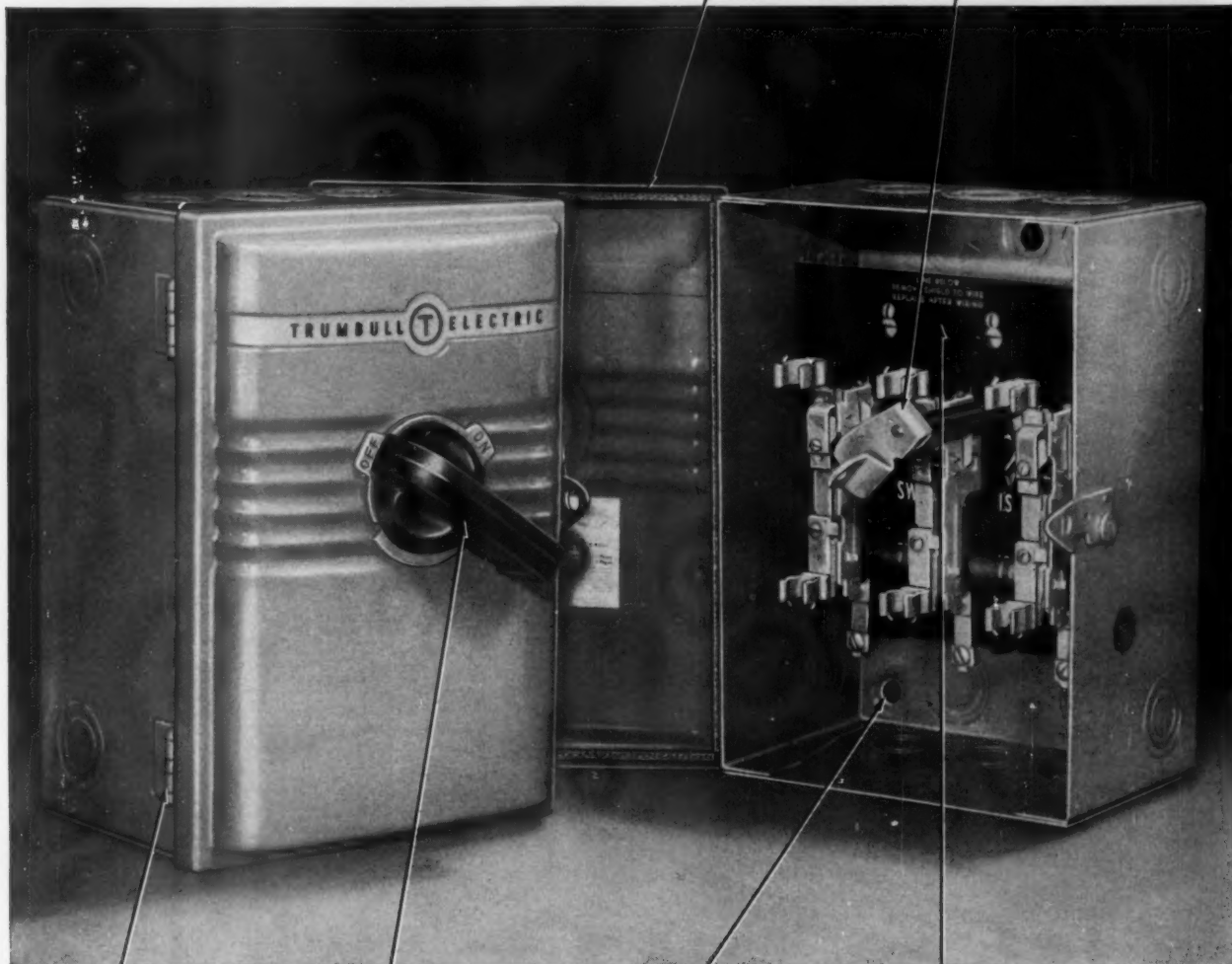
## HERE ARE EXTRA VALUES G-E HEAVY DUTY HCI SWITCHES GIVE YOU

Successfully operates with 100,000-amp interrupting capacity fuses. Test data available. Built for rugged operation under severe conditions.

NEMA 1A enclosure with rubber gasket is standard. Semi-dust tight for use in dust-laden atmospheres. Bonderite\* treated for corrosion resistance.

Door interlocked. When handle is padlocked either ON or OFF, door cannot be opened. If desired, up to three padlocks can be used.

*\*Parker Rust Proof Company*



Piano hinges on door. More rigid, more durable. A G-E safety measure. Heavy steel box takes plenty of abuse.

Front-operated die-cast aluminum handle. Strong, unbreakable, easy to grip. Makes close ganging easy.

New "Tripod Mounting" permits firm installation on irregular walls. Rough handling won't shake box loose.

Line Shield guards against accidental contact. No live parts are exposed when switch is off and door open.

**G-E's heavy duty HCI switches** are sturdily constructed to withstand severe electrical and mechanical stresses. Available in ratings from 30 to 200 amps, 125 to 600 V AC and 240 V DC in two- or three-pole construction. For quick delivery call your G-E Trumbull Distributor. For switchboard and industrial control applications HCI disconnects are easy to mount, have many cost-saving features.

**GENERAL**  **ELECTRIC**



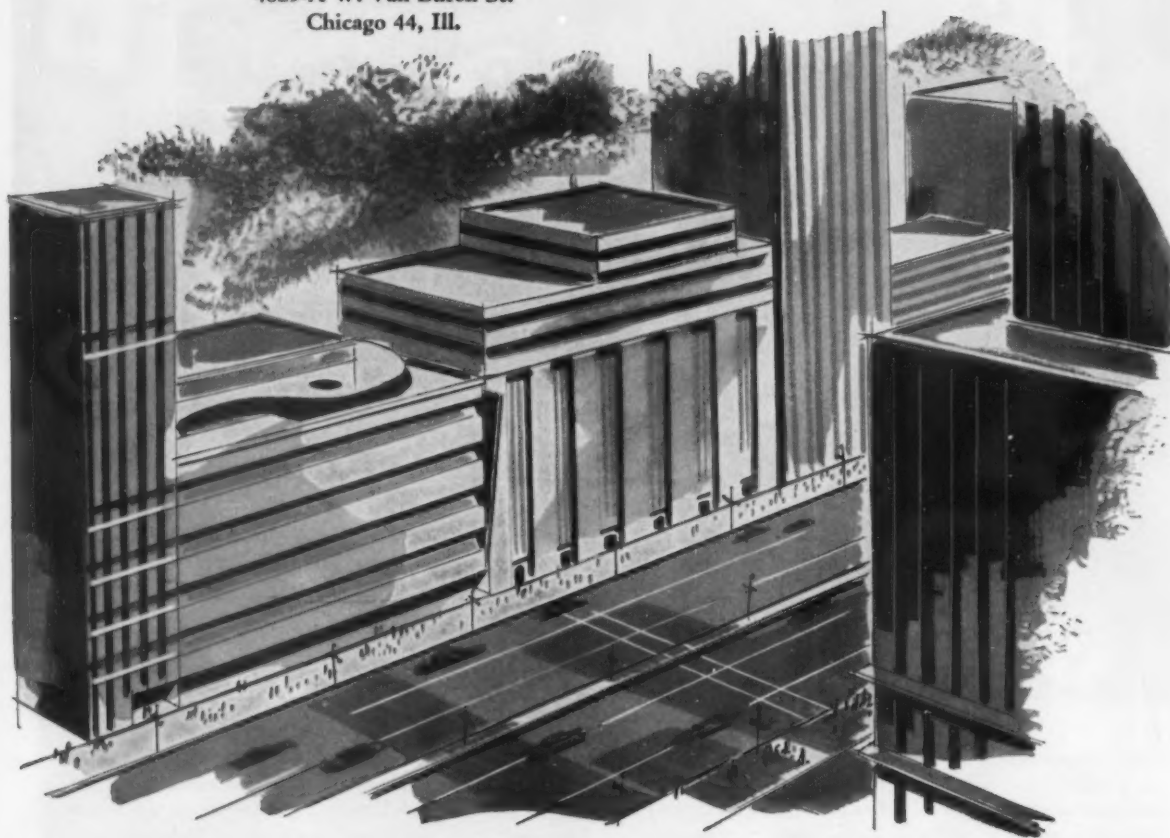
# "Talk-Don't Walk"

## MODERN BUILDING PLANS SPECIFY COMPLETE INTER-COM SYSTEMS

Good inter-com systems are just as accepted as a part of today's architecture as its modern design. Permanently built-in communication systems naturally include the long-life, trouble-free characteristics provided by Belden Inter-Com Cables.

There is a specialized Belden Cable for every inter-com or sound system requirement.

Belden Manufacturing Co.  
4623-A W. Van Buren St.  
Chicago 44, Ill.



For *Permanent* Installations  
For Profitable Work

FOR EVERY TYPE OF INSTALLATION  
FOR EVERY TYPE OF EQUIPMENT  
BELDEN HAS THE CABLE BUILT TO  
SPECIFICATIONS

# Belden

*Inter-com*  
**CABLE**

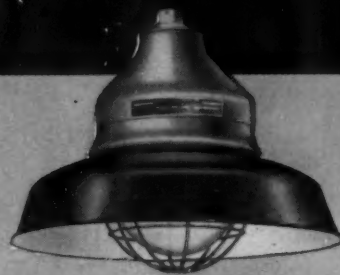


the **S**witch is to **PYLE-NATIONAL**

## industrial lighting fixtures

### EXPLOSION-PROOF

LE Series (Class I, Groups C and D)  
60 to 500 Watts  
Choice of body and reflector styles



### DUST-TIGHT

DE Series (Class II, Groups E, F and  
G and Class III)  
60 to 200 Watts  
Choice of body and reflector styles



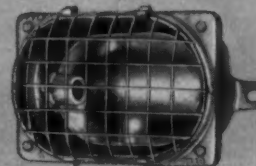
### VAPOR-TIGHT

DO Series 10 watt signal  
or pilot lights  
BO Series 50 to 500 watts  
Choice of body and reflector styles



### FLUSH VAPOR-TIGHT

Type 1570 Pit and subway lights  
100 and 200 watts



Literature Furnished On Request



Sold Nationally Through Authorized Distributors

## THE PYLE-NATIONAL COMPANY

WHERE QUALITY IS TRADITIONAL

1344 N. Kostner Avenue, Chicago 51, Illinois

District Office and Representatives in Principal Cities of the United States. Export Department: International Railway Supply Co.,  
30 Church St., New York. Canadian Agent: The Holden Co., Ltd., Montreal, Toronto, Winnipeg, Vancouver.

CONDUIT FITTINGS • PLUGS AND RECEPTACLES • TURBO-GENERATORS • MULTI-VENT AIR DISTRIBUTION

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . OCTOBER, 1955





## GREAT HALL—COLLEGE OF THE CITY OF NEW YORK

WILLIAM H. BYRNE, P.E., CONSULTING ENGINEER

# FROM 3.5 TO 35 FOOT-CANDLES

The Rambusch flair for doing architectural lighting without doing architectural violence is exemplified in this installation • Originally the installation consisted of two rows of lanternlike fixtures with amber glass giving three and one-half (3½) foot-candles of light • Due to the 14" thick tile ceiling a normal downlight installation was impractical hence special fixtures were designed and hung just below the ceiling. Each of these houses four (4) 1000-Watt Downlites resulting in a uniform level of thirty five (35) foot-candles discreetly covering the floor • There are 100 Rambusch lighting representatives throughout the country—one of them is near you and anxious to serve you.

**RAMBUSCH** DESIGNERS • MANUFACTURERS  
40 WEST 13th STREET, NEW YORK 11, N. Y.



# **CADWELD**

## **ELECTRICAL CONNECTIONS**

**CARRY FULL  
ELECTRICAL LOAD**

**COPPER  
TO STEEL**

Two 1,000 MCM  
copper cables CAD-  
WELDED to one bridge  
power feeder rail.

**LUGS**

Power panel with  
1,000 MCM cables  
CADWELDED to  $\frac{3}{8}$ "  
 $\times$  2" offset lugs.

**BUSBAR**

Weld of six  $\frac{3}{8}$ "  $\times$  4"  
busbars for plating  
tank installation.

The ability of a connection to withstand overloading is extremely important in any electrical installation. The CADWELD Connection is the best in this respect.

When the molten CADWELD metal solidifies, the conductors are no longer two pieces held together, but one continuous conductor.

*The CADWELD connection  
is 100% electrically efficient.*

# **CADWELD®**

**Erico Products, Inc.**

2070 E. 61st Place

Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario



# Know What's New



## New SILENT Mercury Switch

with lighted handle as added feature . . .  
has extra long life



Single Pole

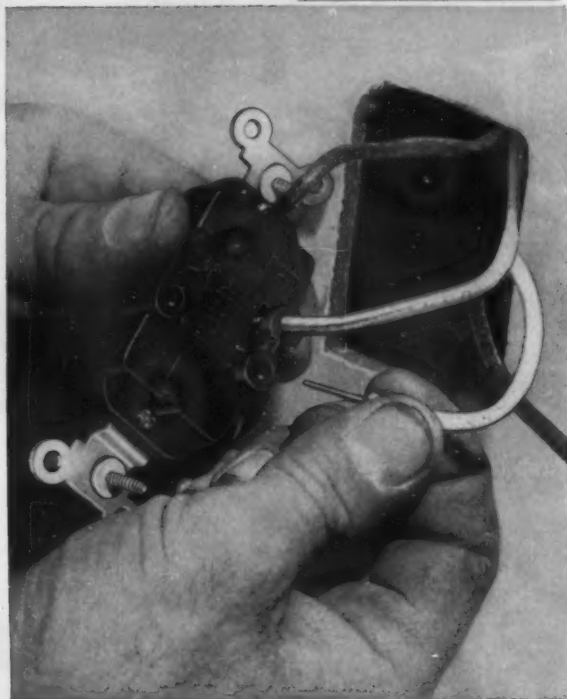


Thru. 3-Way

Turns lights ON and OFF without making any sound at all. When light is OFF, a tiny neon lamp inside the handle goes on . . . makes this G-E Silent Mercury Switch easy to locate at night. Will give years of service under normal usage. Cost of operation varies with electrical rates but, on an average, is less than 1c a year.

As in all G-E Mercury Switches, a quiet pool of mercury makes or breaks the circuit. There is no mechanical action to wear out. Fewer parts to wear mean longer switch life. Life tests on these switches have run a million cycles without failure.

Ideal for installation at home entrances, in hallways, bedrooms, bathrooms, hospital rooms, hotel rooms, and motels . . . all locations where a soft light will help to spot the switch in the dark.



## PRESSURE-LOCK Terminals

G-E offers a complete line of wiring devices with this feature



30 Switches



15 Outlets



3 Ceiling Lampholders

In outlets, switches, and lampholders, General Electric offers the most complete line of devices with pressure-lock terminals. This is the new wiring method, developed by G.E., that eliminates binding screws, provides a 20% better contact, simplifies device installation, and makes a pressure connection for long, dependable service. Pressure-lock terminals have proved so valuable that General Electric has extended this new feature to a wide range of devices.

Pressure-lock terminals make wiring easy, whether you use No. 10, No. 12, or No. 14 Awg. wire. Just strip off the insulation, push wire into the terminal openings, and the G-E pressure-lock terminal grips the wire for a firm, dependable connection. Wires can be removed easily from terminals simply by inserting a screwdriver into release slots.



# -You'll Profit More



## New SURFACE WIRING Devices

with Pressure-Lock terminals cut costs



Double Outlet



Single Pole Switch



Keyless Lampholder



Pull Chain Lampholder



Lampholder W/Outlet

The G-E line of Surface-Mounted Devices with Pressure-Lock Terminals is designed for low-cost wiring ease. Devices are totally enclosed . . . no exposed current-carrying parts, and no parts to disassemble. Pressure-Lock terminals give firm, positive electrical and mechanical connection.

To wire, simply strip non-metallic cable to gage on back of each device. Insert screw driver in slot at desired end of device and remove plastic pryout. Insert stripped cable in opening, push cable until locked in place by pressure-lock terminals . . . pull cables to make sure of firm seating. Staple each cable within 6 inches of device, fasten device to surface with wood screws provided.

These are just a few of the new products developed by General Electric to help the electrical contractor do a better wiring job, more easily.

**Ask your G-E distributor to show you** some of the many new features that have been added to General Electric Wiring Devices. Here are features that consumers as well as contractors appreciate. Product improvements that build demand for the quality lines — like the new Lighted Handle on the popular Silent Mercury Switch, and Pressure-Lock terminals on complete lines of G-E devices, including the new Surface Wiring line.

**You can depend on General Electric —** for the newest developments in wiring devices, for quality products, and a breadth of line that includes everything needed to handle wiring jobs — commercial or industrial, residential or rural. In short, you can depend on G.E. for *more profit*—every time!

**See the complete line of G-E Wiring Devices** at your distributor's. It's constantly expanding, and every new product or product improvement is designed to make your wiring job easier, to increase your profit on every job, and add to your prestige as an electrical contractor. Wiring Device Dept., General Electric Co., Providence 7, R. I.

**Just off the press!** New General Electric Wiring Device catalog. Completely revised, simplified, and up-to-date. Contains all essential data on the complete line of G-E wiring devices. Indexed for quick reference. Send for your copy of this authoritative, easy-to-use buying guide. It's free. Write today.



*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**



**Wagner®**  
ELECTRIC MOTORS  
... the choice of leaders  
in industry

New NEMA Frames  
Standard and Explosion-proof



Type EP  
215 Frame

## Wagner Totally-Enclosed Fan-Cooled Motors

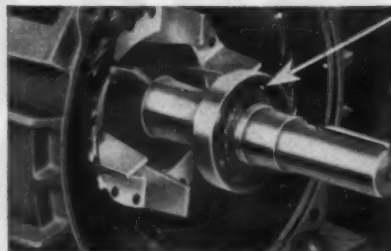
*cut maintenance time and costs*

Check the features of the new *Wagner Type EP Totally Enclosed Motor*. They spell the difference between needless expenditures in maintenance time and costs . . . and a definite savings in motor upkeep and repairs. You'll find that for general industrial use where dust, dirt, filings, abrasives, steel chips or moisture are present, the Wagner Type EP Motor gives steady, troublefree performance and longer service life.

*Wagner Type JP Explosion-Proof Motor* . . . has the same quality construction as the Type EP — plus added features which make it completely safe to operate where explosive dust, gases or vapors are present.

Both Type EP and JP Wagner motors are available in ratings up to 250 horsepower. For complete information, just call the nearest of our 32 branch offices, or write for Bulletin MU-203.

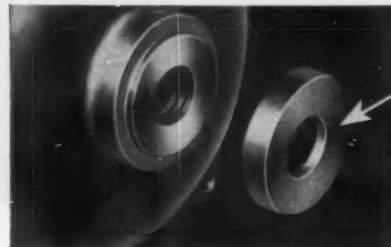
**Wagner Electric Corporation**  
6413 Plymouth Ave., St. Louis 14, Mo.



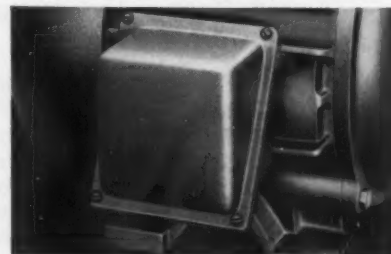
1 HEAVY-DUTY BALL BEARINGS—Highest quality bearings of more than ample capacity provide long, troublefree service.



2 BEARINGS CAN BE RE-LUBRICATED—Wagner motors can be re-lubricated when necessary to prolong bearing life.



3 BEARINGS STAY CLEAN—Both ends of these motors are equipped with running shaft seals, a machined collar mounted on the motor shaft.



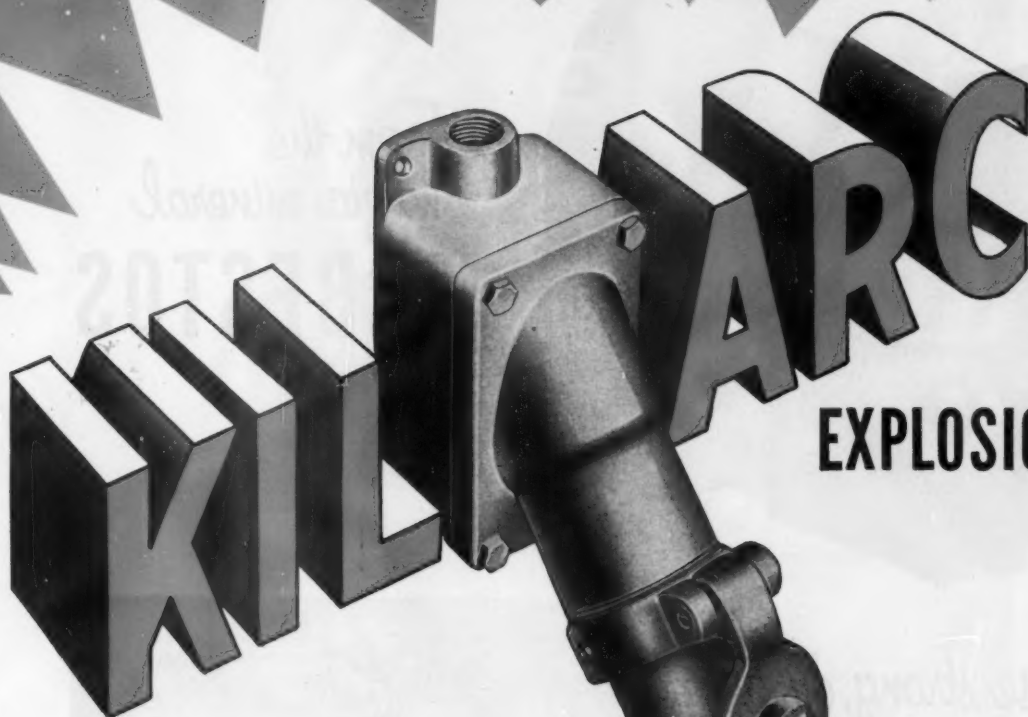
4 EASY TO CONNECT—Large diagonally-split conduit box provides ample room for making connections. Leads are permanently identified.

5 NO GREASE LOSS—Bearing housings have effective seals to prevent escape of grease.

6 RIBBED FRAME—Ribs on the corrosion-resistant cast iron frames add mechanical strength and increase the surface area for more efficient cooling.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES





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## EXPLOSION-PROOF PLUGS and RECEPTACLES

### NON-SPARKING

Plug striking against receptacle can't cause a spark. Safety Time Delay prevents arcing even when improperly sealed. U. L. approved. Exceeds safety tests by a wide margin.

### LIGHTWEIGHT

Ruggedly constructed of Killark ALUMALLOY. Durable, smooth, highly resistant to constant, rough usage.

### RUST & CORROSION PROOF

Unaffected by various types of moisture, atmospheric conditions. Built for lifetime wear.

Available in many sizes and styles to fit various boxes, switches or pilot lights. Made in 15, 30, 60, and 100 amp. sizes.

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in  
**SAFETY FIRST**

for the electrical connection of  
portable equipment



*Killark*

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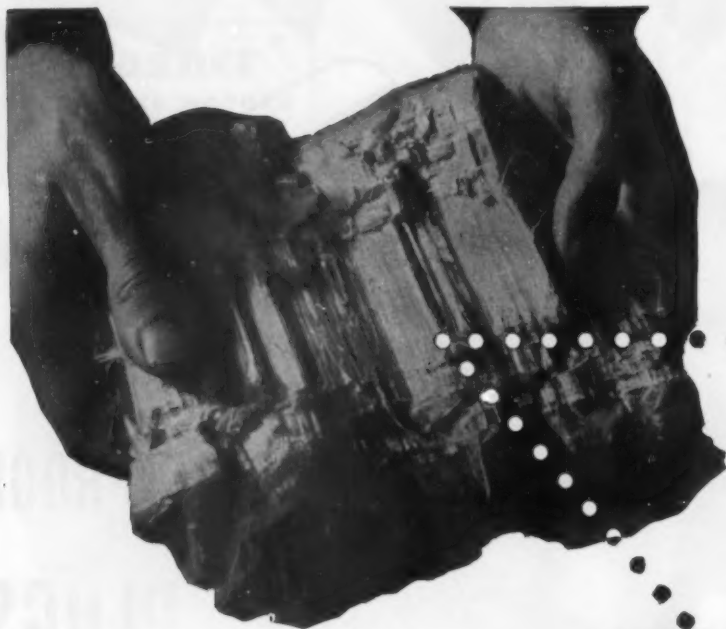
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SALES OFFICES and WAREHOUSE STOCKS	Boston	49-51 D St.	Denver	1073 Galapago	Pittsburgh	4830 McKnight Road
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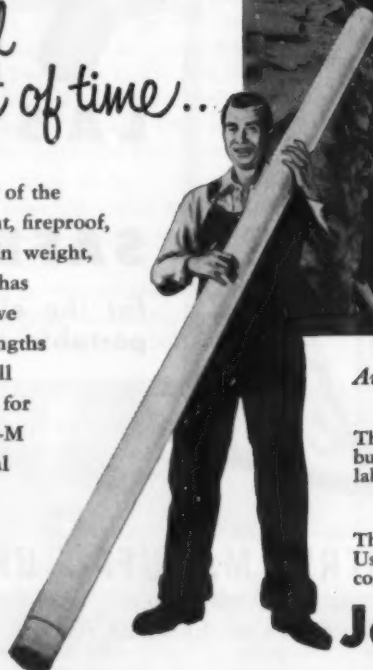
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magic mineral*  
**ASBESTOS**

*come these strong, durable*

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Transite\* meets every requirement of the ideal duct material. It is permanent, fireproof, corrosion resistant, strong, light in weight, smooth-bored, non-inductive, and has rapid heat dissipation. No protective coating is required. The 10-foot lengths are rapidly assembled. Transite will outlast other duct materials. Write for new, free brochure showing how J-M Transite Ducts can effect substantial savings in both installation and maintenance of cable subways. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.



*Available In Two Types:*

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Thick walled, used for exposed work, or buried without concrete casement saves time, labor, materials.

### **TRANSITE KORDUCT**

Thinner walled for installation in concrete. Used for high-voltage lines, its high thermal conductivity cuts operating losses.



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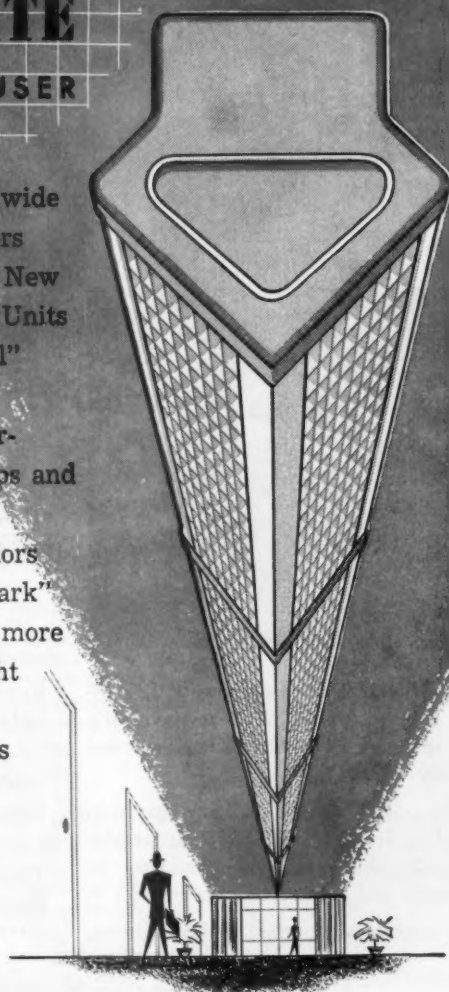
make hallways say, "Come in!"

# new Guth V·C·U

with "V" CORRIDOR UNIT

**GRATELITE\***  
LOUVER-DIFFUSER

At last—you can fill wide hallways and corridors with practical light! New Guth "V" Corridor Units provide "wall-to-wall" illumination. The GRATELITE Louver-Diffuser shields lamps and is easily maintained. Hallways and corridors "come out of the dark" and turn into safer, more cheerful lines of light that guide the eyes and the step. V·C·U's available in 4' & 8', 1 & 2 light models.



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Write today on your letterhead  
for complete information.

**THE EDWIN F. GUTH CO. ST. LOUIS 3, MO.**



"We get  
repeat  
business  
with  
*Day-Brite*"



▲ Francis J. (Bud) Hoch of Industrial Electric Company, Oklahoma City, Oklahoma, inspecting a CFI louver.



◀ Mechanical Room of the Oklahoma Publishing Company, re-lighted with Day-Brite CFI (*Comfort For Industry*) fixtures.

"Day-Brite fixtures are top quality throughout. They give us a job we're proud of—the same goes for architects, engineers and owners.

"Rows go up straight and stay that way. Leveling is easy. Installation is simple. Naturally, this saves time—eliminates re-alignment and 'come-back' calls.

"Our customers are proud of their lighting,

its good performance, clean-cut appearance and easy maintenance.

"Because our customers are pleased and satisfied with their lighting we get repeat business when we install Day-Brite."

\* \* \*

These comments by "Bud" Hoch of Industrial Electric are typical of the way contractors everywhere feel about Day-Brite.

***Day-Brite Lighting, Inc.***

5402 Bulwer Ave., St. Louis 7, Mo.



5490

**NATION'S LARGEST  
MANUFACTURER OF COMMERCIAL AND  
INDUSTRIAL LIGHTING EQUIPMENT**





## Like Lifetime Protection? GET **NE Sherarduct** RIGID STEEL CONDUIT

Sherarduct Rigid Steel Conduit gives you lifetime protection against corrosion. Here's why:

First, NE's Sherardizing process of dry galvanizing alloys pure zinc with the conduit walls, fortifies the steel against rust and corrosion permanently. Second, Shera-enamel, a special, baked-on coating, further protects the conduit from acids and other corrosives.

This double corrosion protection covers the entire surface—inside and out, including the hills and valleys of every thread.

And there are other Sherarduct advantages:

Easy fishing for example . . . in addition to a smooth inside surface, Sherarduct's accurately cut threads let conduit ends butt inside the coupling . . . eliminate gaps that increase friction.

Sherardizing normalizes the conduit metal by gradual heating and cooling in an annealing-like process. This means easy bending and forming on the job.

Write for your free Sherarduct facts book . . . see how the Sherardizing principle makes Sherarduct "galvanized conduit at its best."



### LIFETIME CORROSION PROTECTION

- EASY FISHING
- ZINC PROTECTED THREADS
- STRONG COUPLINGS
- THOROUGH GROUNDING
- EASY BENDING

Listed by Underwriters' Laboratories, Inc:

**Sherardizing is galvanizing at its best . . . Sherarduct is galvanized conduit at its best**



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McGILL 5025-SLRG

## *the grounded portable lighting*

for modern plants

McGill 5000 series grounded service lights feature the convenience outlet and plug adopted as standard by Underwriters' and the National Electrical Code. Blade arrangement includes parallel blades and U shaped third blade for ground. This heavy duty portable and any attached power tools are completely grounded. Molded phenolic handle is heat and impact resistant and positively insulated. Heavy wire cage featuring end lens is zinc plated with chromate finish. Available with or without black rubber 16-3SJ cord and Levolver Switch.

## McGILL® *lamp guards*

STAND THE WEAR  
AND ABUSE OF  
HEAVY USE



McGILL 7000-5R

The most popular all purpose portable lamp guard ever produced, the McGill 7000 series, has extra heavy steel wires electrically welded with a chromate finish over a heavy zinc plate. Pliable molded rubber handles provide cord seal and strain relief disk. Lampholders are 660 watt 250 volt either plain or waterproof. No-Rol feature. Available with or without Levolver switch and 18-2-SJT black rubber cord. Will last many times longer than ordinary portable in all heavy duty industrial applications.

*all are  
McGILL  
quality*



McGILL 3006

## *water-tight vapor-tight and moisture proof*

portable lighting

These 3000 series McGill Vaporproof portables are used extensively in flour mills, elevators, ships, food processing plants and warehouses to eliminate hazards of shock, glass splinters and sparks from broken bulbs. A heat and impact resistant globe seals against the molded phenolic handle to guard the bulb from splashing liquids. The best in protective portable lighting available in 60 or 100 watt bulb size with either metal or fibre cages.

## **NEW** *portable* for spot or flood lamps



McGILL 7000-30

Designed in two sizes for 75 or 150 watt spot or flood lamps this new series offers an especially durable portable that throws light into ordinarily inaccessible places. Cages available for both PAR-38 or R-30-75 lamps on a pliable rubber handle, are standard with or without Levolver switch. The newest thing in dependable portable lighting. Underwriters' approved as are all McGill Portable Lamp Guards.



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**FLUORESCENT LAMP  
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**Heavy Duty Time Switch  
with the Astronomic Dial**



Put the Sangamo Heavy Duty Time Switch, equipped with Astronomic Dial, to work on your lighting installations. The Astronomic Dial controls switching schedules automatically in exact accordance with sunrise and sunset (or off before midnight, if you wish)...you needn't go near the switch.

With or without Astronomic Dial, the Sangamo Heavy Duty is the time switch you can put in and forget...you won't have any callbacks, any complaints, any service calls to make. This is because the Sangamo Heavy Duty

is a sturdy, precision time switch that gives unfailing on-off control.

*Automatic Carryover.* Only the Sangamo Heavy Duty Time Switch is available with the electrically-wound Automatic Carryover which keeps it running during a power outage...as long as ten hours, in fact...and eliminates resetting.

Your electrical wholesaler can furnish you with all types of dependable Sangamo Time Switches.



**SANGAMO ELECTRIC COMPANY**

SPRINGFIELD, ILLINOIS

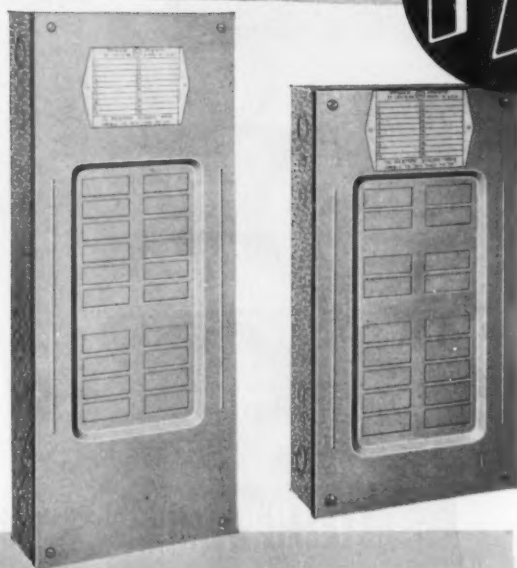
ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . OCTOBER, 1955



for the home of **TODAY AND  
TOMORROW**



## **SPLIT-BUS** *circuit breaker type* **SERVICE EQUIPMENT**



**SPECIFIC DATA ON SPLIT-BUS SERVICE EQUIPMENT**

CATALOG NO.	AMP. MAIN CAPACITY 3-WIRE SINGLE PHASE	MAXIMUM NO. BRANCHES		SIZE
		DP	SP	
Ⓐ SE4DPL100-8SPL50	100	4	10	9"x18"x3 3/4"
Ⓐ SE6DPL100-10SPL50	100	6	10	9"x24"x3 3/4"
Ⓐ SE6DPL200-10SPL50	200	6	10	9"x24"x3 3/4"

Circuit Breakers are Ⓐ T-M and QP, thermal magnetic, quick-make and quick-break. Capacities are 10 to 50 amps. Two pole common trip plug-in type circuit breakers also available in new units. Adjoining single pole branches can be fitted with handle extension for double pole, individual trip operation.

Ⓐ Split-Bus Service Equipment has been specifically designed to solve the ever-increasing problem of expanding residential power demands.

Approved by the Underwriters' Laboratories, Inc., for label service, these units provide capacity for electric ranges, water heaters, driers, air-conditioning, etc., and sub-feeder to additional outlets of distribution.

The units are of the panel base assembly type. They have 100 or 200 amp., feeder capacity for single phase solid neutral service.

The 100 amp. unit is of two types — one having space for four double pole and 10 single pole branches and the other for six double pole and 10 single pole branches. The 200 amp. unit also makes provision for six double pole and 10 single pole branches.

The new units plus a stock of individually-packaged Ⓐ T-M and QP thermal magnetic quick-make and quick-break plug-in type circuit breakers, meet almost any requirement.

Include these new units in all residential type of construction. Your nearest Ⓐ representative, listed in Sweet's will be glad to tell you about them. Or see your Ⓐ distributor for this Service Equipment.

*Frank Adam Electric Co.*

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● Look under "The Youngstown Sheet and Tube Company" in one of these alphabetical or classified phone books.

They represent the 28 conveniently located district sales offices Youngstown maintains across the country. Offices staffed by men who understand your problems and who are qualified to help you get the conduit you need.

If you aren't in touch now with a distributor of Youngstown Buckeye Conduit, just call the Youngstown district office nearest you and they will help you solve your conduit problems.



## THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of  
Carbon, Alloy and Yelow Steel

General Offices Youngstown, Ohio    District Sales Offices in Principal Cities.

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# INTERCHANGEABLE PUSH-BUTTON CONTROLS



## INTERCHANGEABLE . . . SO YOU CAN ASSEMBLE TO MEET ANY JOB REQUIREMENTS

You can assemble control stations that meet your job requirements exactly, because all A-H control units are completely interchangeable (within each of the 3 basic lines) and adaptable to local or remote control. A large number can be assembled in special, small-size, space-saving panel boards. Compactness that facilitates convenient positioning also simplifies installation and servicing.

**STANDARD DUTY LINE . . .** for use under all usual operating conditions up to 600 volts.

**HEAVY DUTY LINE . . .** has a greater contact capacity and is able to handle higher control currents and stand up under more rigorous operating conditions.

**OIL TIGHT HEAVY DUTY LINE . . .** is ideal to protect controls positioned on machine tools and other equipment where spraying or flooding with cutting oil or similar fluids is likely.

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CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_



# THESE LONG LIFE BRYANT QUALITY A. C. SWITCHES OPERATE AT TWICE THE CAPACITY OF CONVENTIONAL SWITCHES

## No. 4801

15 Amperes 277 Volts  
(Brown Plastic Housing).  
Single Pole, Double Pole,  
3 & 4 Way Types. Brown or  
Ivory Handles, Lock Types.

## No. 4901

20 Amperes 277 Volts  
(Brown Plastic Housing  
with Red Cover). Single  
Pole, Double Pole &  
3-Way Types. Brown or  
Ivory Handles, Lock Types.

**Fewer Switches Needed**—Nos. 4801 and 4901 Bryant A. C. Switches can be used at full rated capacity on fluorescent (inductive) loads. This means *twice* the capacity of existing switches—thus fewer switches are needed—saving real dollars and cents.

### Other Applications

- Capable to full rated capacity on Tungsten filament lamp loads
- Motor Control—will safely handle up to 80% of switch rating
- 277 Volt rating permits use on 4-wire 480/277 volt networks

### Features For Years of Trouble-Free Performance

- Silver contacts ensure long life
- Quiet operation—where minimum switch noise is desirable
- Screw clamp terminals for easy wiring—straight in from the back
- Large head terminal screws for conventional side wiring
- Either wiring method accommodates up to No. 10 solid or stranded wire
- Fully enclosed in strong plastic housings—keeps out dust and dirt
- Meet all specifications

Listed By Underwriters'  
Laboratories, Inc.



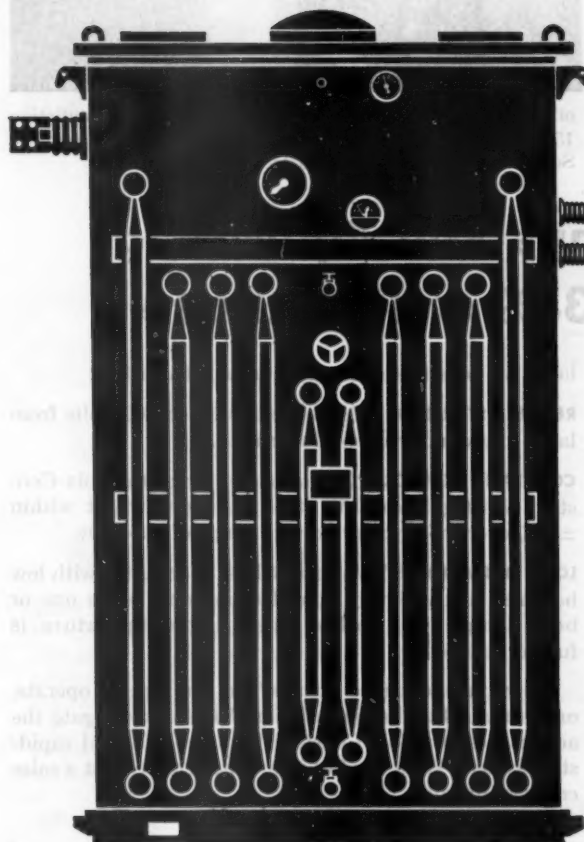
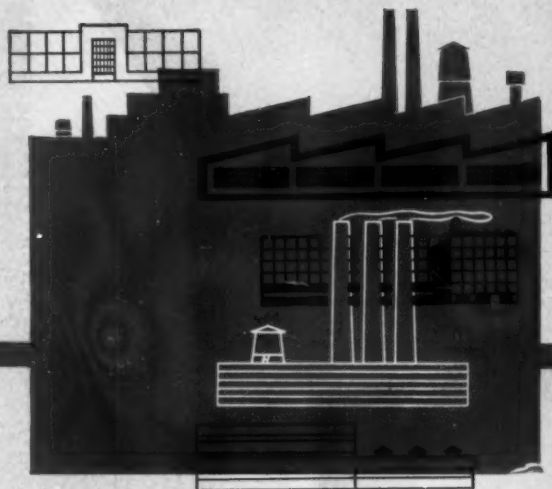
## THE BRYANT ELECTRIC COMPANY

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J-99949



# KUHLMAN SAF-T-KUHL TRANSFORMERS GIVE SAFER, LOWER-COST PERFORMANCE



Kuhlman Saf-T-Kuhl Transformers are filled with a patented synthetic cooling compound that is equal or superior to oil in di-electric strength, fluidity and thermal capacity. Yet the coolant is inert, non-explosive, non-inflammable and it will not sludge. The advantages of any unit employing such a coolant are well known.

- Saf-T-Kuhl Transformers can be installed anywhere in the plant without the use of expensive fireproof vaults.
- Voltage regulation can be improved and energy losses reduced by installing Saf-T-Kuhl Transformers near load centers and the expense of running long and large copper conductors can be eliminated.
- Floor space can be utilized exclusively for production by installing Saf-T-Kuhl Transformers above or below floor level.
- Maintenance costs are lower because the coolant does not require filtering or reconditioning.
- Insurance rates are lower in most states because Saf-T-Kuhl Transformers are absolutely safe and fireproof.

Saf-T-Kuhl Transformers are especially engineered to meet the requirements of heavy duty industrial service. The entire insulation structure is coordinated with the basic impulse level. Assemblies are thoroughly dried, and the coolant is introduced under vacuum to prevent entrapment of air and insure high insulation strength. Large ducts permit free circulation of the coolant to eliminate the danger of hot spots. Tanks are completely sealed. Cover and bushing gaskets are made from a special cork and synthetic rubber compound that gives exceptionally long life.

Kuhlman Saf-T-Kuhl Transformers are produced in a wide variety of single and three phase ratings. For complete information, write today for Bulletin CS-501. Kuhlman also manufactures, Power, Distribution, Dry Type, Subway, CSP and Series Street Lighting Transformers. Ask for bulletins on these units as well.

154-T

## KUHLMAN

KUHLMAN ELECTRIC COMPANY, BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA





**LAMP LIFE TEST:** On the left is the start of a rapid-start lamp life test in the Sola laboratories. Below the lamps are three Sola Constant Wattage Ballasts and a like number of each of three



other leading brands. At the right, you see the test installation 15 months later. The six lower lamps are operating from the Sola Constant Wattage Ballasts.

## Sola-Ballasted Lamps Still Operating After Exceeding 133% of Rated Life

With rapid-start lamps operating on a continuous cycle of three hours on and twenty minutes off, this test installation provides a convincing comparison of rapid-start ballast performance. Ten months after starting date, four ordinary ballast-operated lamps had failed; and during the 14th month, two more of these were out. Yet — after more than 15 months — every test lamp operating from Sola Constant Wattage Ballasts still provided constant light output and reliable starting. This record of 9,980 burning hours is 33% in excess of rated lamp life.

This longer lamp life provided by Sola Rapid-Start Ballasts is due largely to optimum starting voltage, to a peak-to-RMS ratio of only 1.51, and to the stabilization of current flow through the cathodes.

When your rapid-start lamps operate from quiet Sola Constant Wattage Ballasts, you can expect the same long

lamp life plus the other advantages listed below:

**RELIABLE STARTING:** Sola Ballasts provide 300 volts from lamp to ground with absolute safety.

**CONSTANT LIGHT OUTPUT:** Incorporation of the Sola Constant Wattage Principle stabilizes light output within  $\pm 2\%$  over the primary voltage range of 106-130v.

**LONG BALLAST LIFE:** The Sola Ballast is designed with low heat rise as a primary consideration and, when one or both lamps fail, ballast operating temperature is further reduced.

Do you manufacture fixtures? Do you specify, operate, or maintain lighting installations? If so, investigate the advantages of a Sola Constant-Wattage-Ballasted rapid-start system. Write for full information or request a sales engineer to call.

**SOLA** *Constant Wattage*  
**BALLASTS**



WRITE FOR BULLETIN 17J-FL-199

**SOLA ELECTRIC CO.**  
4633 W. 16th St.  
Chicago 50, Illinois

**CONSTANT VOLTAGE TRANSFORMERS** for Regulation of Electronic and Electrical Equipment • **LIGHTING TRANSFORMERS** for All Types of Fluorescent and Mercury Vapor Lamps. • **SOLA ELECTRIC CO.**, 4633 West 16th Street, Chicago 50, Illinois, Bishop 2-1414 • **NEW YORK 35:** 103 E. 125th St., TRaifaigar 6-6464 • **PHILADELPHIA:** Commercial Trust Bldg., Rittenhouse 6-4988 • **BOSTON:** 272 Centre Street, Newton 58, Mass., Bigelow 4-3354 • **CLEVELAND 15:** 1826 Euclid Ave., Prospect 1-6400 • **KANSAS CITY 2, MO.:** 406 W. 34th St., Jefferson 4382 • **LOS ANGELES 23:** 3138 E. Olympic Blvd., ANGelus 9-9431 • **TORONTO 9, ONTARIO:** 617 Runnymede Rd., Lyndhurst 1654 • **Representatives in Other Principal Cities**



The wiring in the average structure to-day  
is entirely inadequate for the load required  
by many new electrical appliances.

# What Can Be Done About It?

## Rewire with CRESCENT!



### TYPE TW BUILDING WIRE

#### GET GREATER CURRENT CARRYING CAPACITY IN THE SAME CONDUIT

Many building owners do not realize the need for more adequate wiring of their property. The electrical contractor can offer a real service by recommending the rewiring of existing circuits with CRESCENT SYNTHOL TYPE TW BUILDING WIRE. As shown by examples to the right, this considerably increases the current-carrying capacity.

#### 1/2" CONDUIT



ORIGINAL  
INSTALLATION  
(Wires already in)

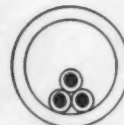
3 conductors of  
#12 wire with  
maximum current  
rating of



REWIRE  
(As permitted by N.E.C.)

Will permit installation  
of 3 conductors of #8  
CRESCENT SYNTHOL  
TYPE TW WIRE, there-  
by doubling the maxi-  
mum current carrying  
capacity in the same  
existing conduit to

#### 3/4" CONDUIT



ORIGINAL  
INSTALLATION  
(Wires already in)

3 conductors of  
#10 wire with  
maximum current  
rating of



REWIRE  
(As permitted by N.E.C.)

Will permit installation  
of 3 conductors of #6  
CRESCENT SYNTHOL  
TYPE TW WIRE, there-  
by increasing the maxi-  
mum current carrying  
capacity in the same  
existing conduit to

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30 AMPS.

55 AMPS.



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TRENTON, NEW JERSEY







## Inside Houston's new Texas National Bank Building...

ARCHITECT: *Kenneth Franzheim*

ENGINEERS: *Howard & Johnson*

ELECTRICAL CONTRACTOR: *Howard P. Foley*

*This is the first building in Houston, Texas, using  
the new 277/480 volt—3 phase—4 wire system.*

...they bank on  
REG. U.S. PAT. OFF.  
**40,000 SCOTCHLOK**  
BRAND  
wire connectors!

480 line-to-line voltage calls for top-quality connections, top-quality insulation. That's why Howard P. Foley, electrical contractor for the new Texas National Bank Building in Houston, chose "SCOTCHLOK" connectors and "Scotch" Brand No. 33 Plastic Electrical Tape.

"SCOTCHLOK" is the tightest-gripping wire connector on the market. It never shakes loose. "Scotch" 33 is the original, and still finest, plastic electrical tape. Try this top team on your next wiring job! Write 3M, Dept. CB-105 St. Paul 6, Minn.

REG. U.S. PAT. OFF.  
**SCOTCHLOK**  
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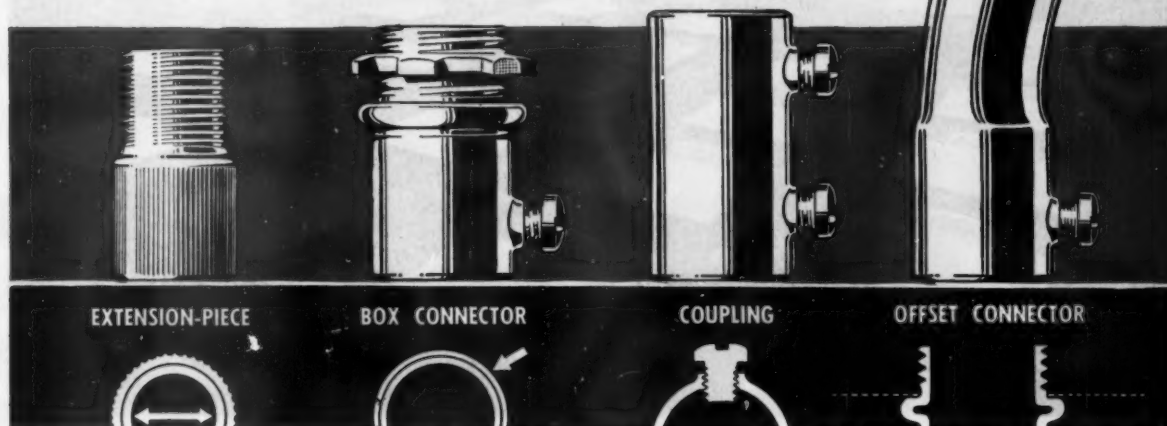
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COUPLING

OFFSET CONNECTOR



Look closely at every detail of this new line... "Tube-Weld". Its advantages are basic!

All fittings are precision-made of one piece heavy gauge welded steel tubing which has been accurately drawn and sized for controlled uniformity. These fittings cannot open or spread and far surpass U L requirements.

They are made by Electric Tube Products, a division of Berger Machine Products, with over 36 years manufacturing experience.

Tube-Weld fittings represent an entirely new concept in quality, design and price. They are available in  $\frac{1}{2}$ ",  $\frac{3}{4}$ " and 1" sizes and have the following features:


- Oversized hardened steel set screws are used throughout and are staked for permanency!
- Extra long length of offsets provide exceptionally easy pulling of wire.
- Longer length of fitting provides maximum support for conduit.
- Connector shoulders are uniformly flat assuring perfect centering in the box.
- All threads are rolled instead of cut and have 54% greater stripping strength and 66% greater snapping strength (independent testing laboratory report) over cut threads.

• Lustrous zinc finish and carefully beveled edges add a distinctive appearance — allow largest inside working diameters.

• Carefully and smartly packaged for ease in shelving and identification. For descriptive brochure and additional information write or call:

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## High Level Lighting for Faster Learning... with Lighting by **LITECONTROL**

Better lighting helps young minds learn faster, more comfortably in this remodeled Harrisburg, Pa., school. Both the original building (above) and the new wing now have their classrooms entirely lighted by LITECONTROL.

LITECONTROL fixture No. 6628 gives plenty of high intensity, low brightness illumination everywhere. Efficiency is an unusually high 86%. Light through the top of the fixture cuts fixture-ceiling contrast and helps minimize glare.

Two-piece construction means installation is fast and simple, whether the units are hung individually or in

continuous rows. Maintenance is easy, too: baffles swing fully open from either side without the use of tools. Fixtures may be cleaned and re-lamped in seconds.

Whether your job is lighting or re-lighting, for a custom installation at standard fixture prices, get in touch with LITECONTROL. Call or write your local representative.

INSTALLATION: Hamilton Elementary School, Harrisburg, Penna.

ARCHITECT: Clayton J. Lappley, Harrisburg, Penna.

ENGINEER: Snyder & Van Horn, Harrisburg, Penna.

ELEC. CONTRACTOR: The Howard P. Foley Company, Harrisburg, Penna.

FIXTURE: Litecontrol No. 6628 and 6624, pendant mounted.

INTENSITY: New rooms (with fixtures hung on 8" stems), average 52 footcandles initially on desks.

Old rooms (with fixtures hung on 24" stems), average 47 footcandles initially on desks.



# LITECONTROL *Fixtures*

KEEP UPKEEP DOWN

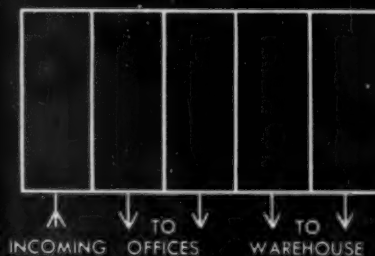
LITECONTROL CORPORATION, 36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS





Wm. Wetzig (right), Jewel Tea Co. engineer, confers with John Corsiglia of Hyre Electric Co. installation contractor



**CUT THE COST OF YOUR HIGH-VOLTAGE**

**SUPPLY SYSTEM BY SPECIFYING S&C**

**METALCLAD SWITCHGEAR... IT DOES THE JOB**

**FOR HALF THE MONEY**

Get off to a good start on the plans for your electrical system by selecting S&C Metalclad Switchgear. That is what A. Epstein & Sons did for Jewel Tea Company's new office-warehouse building. The savings made at the switching center were considerable, and they were reflected in a lower cost high-voltage supply system.

S&C Metalclad Switchgear provides all the necessary protection and switching for high-voltage feeders—at about half the cost of other types of metalclad switchgear. A simplicity of design assures complete dependability with far less maintenance.

Electrical engineers and contractors alike find the experienced recommendations of S&C field engineers extremely valuable in reducing electrical construction costs. Write or phone your nearest S&C field office... they will be glad to assist you.



**MR. SOL KRIVO**

Chief Electrical Engineer for A. Epstein & Sons—Chicago architect-engineers—

planned the high-voltage supply system for the newest Jewel Tea Company building. He says, "Since S&C were the originators of this type of outdoor metalclad switchgear, we are sure they have the 'know-how' to furnish equipment best fitted to our jobs. Our customers have been completely satisfied by the simplicity, low cost, and easy maintenance of S&C Metalclad Switchgear."



*Specialists in  
High-Voltage Switchgear  
for Electric Utilities  
since 1910*

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# ONE O.Z. FITTING DOES THE WORK OF 32

**For Tee or  
Parallel Taps!**

**32** connector  
sizes needed on  
this job!

**ONE** connector  
size is plenty  
with this XTP!

One typical XTP connector replaces up to 32 different parallel or tee connectors because each XTP accommodates a wide range of wire sizes. All told, the XTP line of but 25 connectors will receive over 400-wire size combinations!

For either tee or parallel taps, just snap special hinged clamp over main and tighten the connector permanently in place—positive contact is assured. When you're ready to connect the tap, simply insert wire in tap end of connector. A wrench-turn or two, the job's done!

#### 25 CONNECTOR SIZES do practically all tap jobs.

- Accommodate over 400 combinations of wire sizes
- Fit wire from #8 to 1,000,000 CM

#### HINGED CONSTRUCTION for quick installation.

#### SPRING STEEL LOCK WASHERS (tin plated) maintain pressure.

- Hold resiliency—assure permanent connection

#### PRESSURE PLATES designed for maximum contact and grip.

- Serrated for firm grip
- Can not rotate during installation

#### HIGH STRENGTH, HIGH CONDUCTIVITY.

- High conductivity copper alloy for body
- Extra strength copper alloy for pressure plates and hinged parts

Get these combination fittings from your wholesaler now... and put an end to bulky assortments of tap connectors.



XTP as a T tap



XTP as a parallel tap



High-strength Bakelite insulating covers for XTP fittings. Compact, install with stainless spring clips, no taping.

They're O.K.  
if They're O.Z.



# O.Z.

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CAST IRON BOXES  
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SOLDERLESS CONNECTORS  
GROUNDING DEVICES  
CONDUIT FITTINGS



**"MORE POWER PER POUND"  
WITH G-E INSULATING MATERIALS**

**"25% saving in iron!"**

**15% saving in copper!"**

**Curing time cut in half!"**

*New* **G-E PERMAFIL 73515**  
insulating varnish

That's what one of our customers reports after replacing conventional insulating varnish with General Electric's new Permafil 73515 coil impregnant in transformers!

By taking advantage of the superior heat dissipation of 73515 (it lowered operating temperature 25 degrees C), this customer was able to redesign his transformer line to realize substantial cost savings in materials. And because 73515 cures twice as fast, his manufacturing time was cut and his oven capacity, in effect, doubled.

**Where can YOU use Permafil 73515 profitably?**

Permafil 73515, when properly used, is ideal for impregnating coils in vibrating power tools, FHP stators, and high-voltage transformers and magnet coils. It yields void-free insulation that eliminates corona, increases heat dissipation, and provides relatively constant power factor over a wide range of voltages and temperatures. Through it, you can increase the rating of equipment or maintain its rating while drastically reducing size and weight.

**SEND COUPON FOR TECHNICAL REPORT!**

*Progress Is Our Most Important Product*

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Chemical Materials Department  
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Please send me a technical report and product data sheet on G-E 73515 Permafil.

Name \_\_\_\_\_  
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# New Line of I-T-E Enclosed Circuit Breakers approved for service equipment and commercial buildings

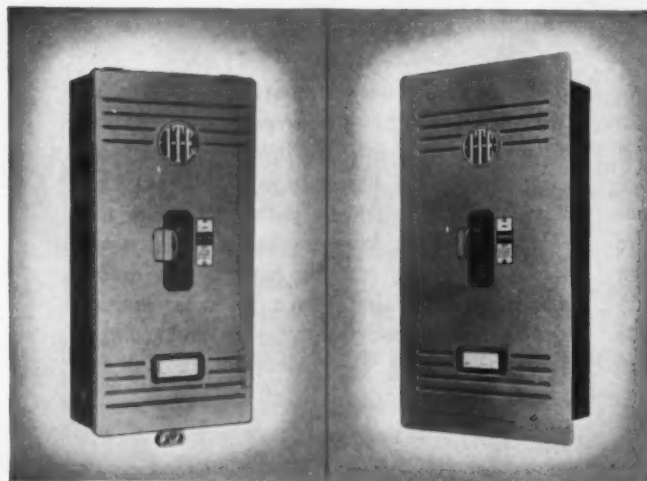
**Ratings: 15 through 200 amp.**

**2 and 3 pole, 240 v a-c, 125/250 v d-c;  
600 v a-c, 250 v d-c**

Bonderized Dimenso finish makes enclosures eye appealing and durable. Card holder permits easy circuit identification. For more details, ask your I-T-E representative or authorized distributor for the Speedfax Catalog. Or write Small Air Circuit Breaker Division, I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Philadelphia 30, Pa.



**NEMA 3** has automatic cover latch which retains cover in fully open position, is equipped with inner dead front sheet which isolates breaker and wiring.



**NEMA Surface Type 1**

**NEMA Flush Type 1B**

For general indoor use where normal atmospheric conditions exist. The breaker operating handle extends through the cover, which mounts a locking bracket.



**NEMA Type 3**

For outdoor use to provide protection against driving rain, snow or sleet. Enclosure is equipped with threaded conduit hub, and matching knockout on bottom.

**I-T-E CIRCUIT BREAKER COMPANY • Small Air Circuit Breaker Division**





G-E LAMPS GIVE YOUR CUSTOMERS MORE FOR ALL THEIR LIGHTING DOLLARS



## How General Electric built a \$7.00 bonus into the \$3.50 slimline lamp

**MORE LIGHT.** The picture above was taken by the glow of the chemical piled on the tray. It's the phosphor used inside the General Electric slimline fluorescent lamp to produce light. It's 19% brighter than it was five years ago. Holds its brightness better, too. Result: over the original 6000-hour life period, today's G-E slimline lamp gives 31% more light than the 1950 slimline.

**LONGER LIFE.** Silhouetted against the glow is a tiny coil of wire. It's the cathode that carries electricity to operate the lamp. It's coiled three times. It holds more starting chemical and holds it longer. This cuts down on early burnouts. And this is the main reason why today's General Electric slimline fluorescent lamp lasts 7,500 hours, compared to the old lamp's life rating of only 6,000 hours.

**COSTS LESS.** With the value going up like this, the price of today's General Electric slimline fluorescent lamp has actually

gone down. Less than a year ago, a price reduction brought case-quantity buyers a net saving of 17¢ per lamp.

To add it all up, counting lamps, labor and electricity; the amount of light G-E slimline gives today would have cost \$7.00 more only five years ago!

For more facts on how General Electric gives your customers more for *all* their lighting dollars, write for a free 16-page Progress Report to Lamp Users: Large Lamp Department, General Electric, Dept. 482-EC-10, Nela Park, Cleveland 12, Ohio.

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**



# Your choice of normal or low starting current... with Performance-Rated

## Century

### HIGH TORQUE, SINGLE-PHASE MOTORS



Capacitor Motors...  $\frac{1}{8}$  to 20 H.P. provide high starting torque, high pull-up torque and require normal starting current. They are available in drip proof, dust proof and explosion proof enclosures.

Even if you have severe starting current limitations, you can select the torque you need for sure starts and smooth pull-up to speed from the Century Performance-Rated Single-Phase line (see bar chart below for operating characteristics of two types of Century Single-Phase Motors).

**Whatever Your Motor Job . . .** there's a Century Motor Performance-Rated to handle it with top effectiveness. Contact your nearby Century branch office or Authorized Distributor.

#### TYPICAL OPERATING CHARACTERISTICS

##### STARTING CURRENT (Important on Heavily Loaded Circuits)

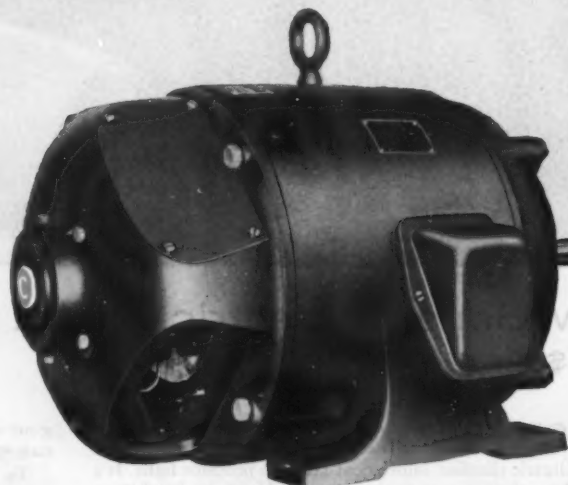
100	200	300	400	500
Capacitor Type $\frac{1}{2}$ of full load				
Repulsion-Start Type $\frac{1}{2}$ of full load				

##### STARTING TORQUE (Torque Available at Break-Away)

100	200	300	400	500
Capacitor Type $\frac{1}{2}$ of full load				
Repulsion-Start Type $\frac{1}{2}$ of full load				

##### PULL-UP TORQUE (Least Torque Available Between Start and Full Load Speed)

100	200	300
Capacitor Type $\frac{1}{2}$ of full load		
Repulsion-Start Type $\frac{1}{2}$ of full load		



Repulsion Start, Induction Motors (type RS)...  $\frac{1}{8}$  to 7  $\frac{1}{2}$  H.P. provide very high starting torque, yet require unusually low starting current. They are available in drip proof and splash proof enclosures.

Performance-Rated  
Motors  
 $\frac{1}{8}$  to 400 H.P.



## CENTURY ELECTRIC COMPANY

1806 Pine Street, St. Louis 3, Missouri • Offices and Stock Points in Principal Cities



## Caution Signals

The year's high construction peak is past. The curve is on its normal seasonal decline. Electrical work is less affected than other construction crafts but is necessarily slowed down as cold weather delays structural work. Traditionally, at this time of year, the growl of the concrete mixers gradually gives way to the whirl of the pencil sharpeners in front offices.

Sharper competition and longer risks in last quarter bidding this year may prove more than usually hazardous. They will be particularly risky if bidders gamble on significant softening of prices toward the year end. These signals suggest caution.

1. Top item is copper. In August it went to 43 cents, the highest price since 1872, but foreign buyers are paying 50 cents. The U.S. is a big producer but a net importer of the red metal. The effects of this new level in raw material cost on many electrical product prices are still to come.

2. Our Electrical Materials Cost Index is predicting a rise, a pattern similar to the last quarter of 1954 but at a higher level. Any fundamental weakness should have caused a dip in the January-February period this year. Instead the index moved upward.

3. Electrical distributors are unhappy about net profit. They are also worried about credit. With a record volume year shaping up, executive attention to net and credit is expected to inhibit sales department flexibility to meet "competitive situations".

The signals are more significant by their concurrence. A new price level for a basic raw material, a modest but stable rise in manufactured product prices and a stiffening of price policy in distribution coming together, suggest that this might be a time to get firm quotations before the bidding.

The situation does not preclude discovery of some good buys or some local soft spots. But the astute buyer should be prepared to find bed rock somewhat closer to the surface than recent experience would indicate.

With 1955 heading toward a record in construction volume and with preliminary estimates for 1956 generally conceding a very favorable outlook, the prudent estimator can well afford a spell of cautious conservatism at this time.

Wm. T. Stuart



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ELECTRIC CO., INC.  
430 Lexington Avenue, New York 17, N. Y.

GRAYBAR





**NEED BETTER VENTILATION?** Portable fans for spot cooling? Circulator and window fans for offices? Self-cooled propeller fans and universal blowers for large-volume circula-

tion? There's a Graybar-distributed unit specially designed to provide all the cool, refreshing air you want. And it's as handy to you as your nearest Graybar office.

## Extra profits out of the air...via GRAYBAR



**FREE  
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Catalog**

Get your **FREE** copy of this fact-filled ILG Catalog — your guide to the best in ventilating equipment. It shows the entire line of ILG ventilating equipment, arranged to make it easy for you to select the unit that's exactly right for each installation. Pertinent data on operation, performance and installation specifications are also included. Write to the address below.

You can up your profits and, at the same time, increase production and lower costs for your customers with Graybar-planned ILG ventilating systems. Adequate ventilation equipment that removes fumes, dust, heat and stuffy air means better production all around. Check off these points and see what a big job fresh air can do.

1. Increases man-hour production
2. Reduces material spoilage
3. Cuts worker fatigue
4. Reduces accidents
5. Lowers labor turnover

Why not consider a free survey on your next job? Just call the Graybar office nearest you — we'll gladly work with you and your customer to find the best answer for his needs.

One thing that's good to remember, Graybar-distributed ILG fans and blowers are the best-designed and best-built units you can get. For that matter, Graybar is an all-inclusive source for *everything electrical* . . . over 100,000 quality items for wiring, lighting, communication, power, as well as ventilation.

520-410

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**ELECTRIC CO., INC.**

**420 Lexington Avenue, New York 17, N. Y.**



IN OVER 130 PRINCIPAL CITIES



**LIGHTING INDUSTRY SALES HEADED FOR . . .**

# WHAT'S AHEAD FOR LIGHTING

## A 10-YEAR PROJECTION

*Analysis of lighting needs reveals \$1 billion annual market by 1965, as more of new building construction dollar goes into lighting and demand for better quality lighting grows stronger.*

**L**IGHTING sales are booming. The lighting industry is today selling more lighting than ever before, and the outlook is even more optimistic. The industry's 1955 volume, estimated at \$390 million last January, is now expected to total \$410 million. This increase is for a higher volume of new construction than was formerly predicted, or a rise from \$39.5 billion to \$41.8 billion. And if business continues its upward trend, as nearly all economic factors seem to indicate, lighting sales annual volume by 1965 should total \$1 billion!

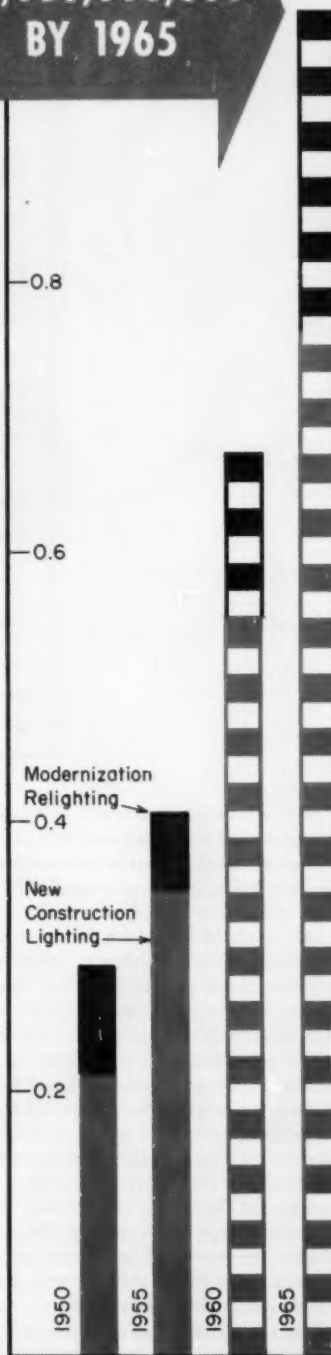
With the nation now enjoying its greatest prosperity in history, and with the entire electrical industry reflecting strong economic growth and steady progress, the various segments of the lighting industry want to know "What's Ahead For Lighting?". To find the answer, many of the key people in the lighting industry were asked this question, and the economic factors affecting the lighting market have been studied. The results are summarized on the following pages.

### **Economic Outlook**

A healthy economy portends a good business climate for the lighting industry. Measured by the usual economic yardsticks, the economy is headed up, and picking up steam. Forecasts for 1956, short-range, are all optimistic. And long-range forecasts, for 10, 20 and 30 years hence, have all been so spectacular as to preclude full comprehension.

**\$1,000,000,000  
BY 1965**

BILLIONS OF DOLLARS





**TABLE I — Markets for Lighting Equipment**  
(Thousands of Dollars)

Item	Type of New Construction	Estimated Lighting Equipment Volume			
		1950	1955	1960	1965
1	NEW CONSTRUCTION — TOTAL LIGHTING	219,715	356,354	549,782	732,225
2	PRIVATE — TOTAL	145,305	241,062	344,870	459,340
3	Residential (Non-farm)	31,500	33,700	45,000	64,600
4	Nonresidential building	104,075	194,600	285,740	378,200
5	Industrial	27,800	57,500	89,500	123,400
6	Warehouses, offices and loft buildings	12,005	32,150	41,400	57,500
7	Stores, restaurants and garages	35,440	63,000	92,200	125,000
8	Other nonresidential building	28,830	41,950	62,040	72,300
9	Religious	10,225	15,000	21,600	22,500
10	Educational	6,610	11,250	20,000	25,300
11	Hospital and institutional	5,500	5,930	8,400	12,000
12	Social and recreational	4,095	4,370	5,740	7,100
13	Miscellaneous	2,400	5,400	6,300	5,400
14	Farm construction	1,225	1,170	1,200	1,250
15	Public Utilities	8,490	11,570	12,894	15,250
16	Railroad	220	320	494	900
17	Telephone and telegraph	1,320	2,250	2,600	2,100
18	Other public utility	6,950	9,000	9,800	12,250
19	All other private	15	22	36	40
20	PUBLIC — TOTAL	74,410	115,295	204,912	272,885
21	Residential building	725	525	720	1,080
22	Nonresidential building	52,550	87,230	163,700	217,850
23	Industrial	4,770	13,000	15,610	15,650
24	Educational	29,500	57,400	102,500	138,000
25	Hospital and institutional	8,680	5,430	30,400	48,000
26	Other nonresidential building	9,600	11,400	15,190	16,200
27	Military facilities	1,300	2,300	4,500	4,200
28	Sewer and water	1,320	1,375	2,100	3,000
29	Miscellaneous public service enterprise	690	1,125	1,150	1,875
30	Conservation and development	440	330	262	380
31	Highway	2,385	4,410	12,480	22,500
32	All other public	15,000	18,000	20,000	23,000
33	MODERNIZATION — TOTAL RELIGHTING	70,000	54,000	120,000	267,775
34	TOTAL LIGHTING MARKET	289,715	410,354	669,782	1,000,000

New construction volume will total about \$41.8 billion this year, and forecasts for 1956 are for about \$44 billion. It has climbed at an unprecedented rate for 11 consecutive years, from a low of \$5 billion in 1944.

In estimating dollar volume for lighting equipment as shown in Table I, which is based on new building construction, the total value of new construction for 1960 was estimated at \$49.2 billion, and for 1965 at \$56.2 billion. These are conservative projections, compared with the record for the past 11 years.

The projections for seven specific types of construction—stores, offices, schools, industrial, church, hospital and highway—are given in Charts III to IX on the following pages. Projections are based on public works construction requirements for schools, hospitals, and highways, as reported by Depts. of Commerce and Labor following surveys of spending plans and needs as reported by States and local governments. Projections for other types of construction were based on indicated trends and on miscellaneous other surveys and information considered sound, reasonable and reliable.

From a lighting sales standpoint, modernization presents a tremendous market. The relighting market in

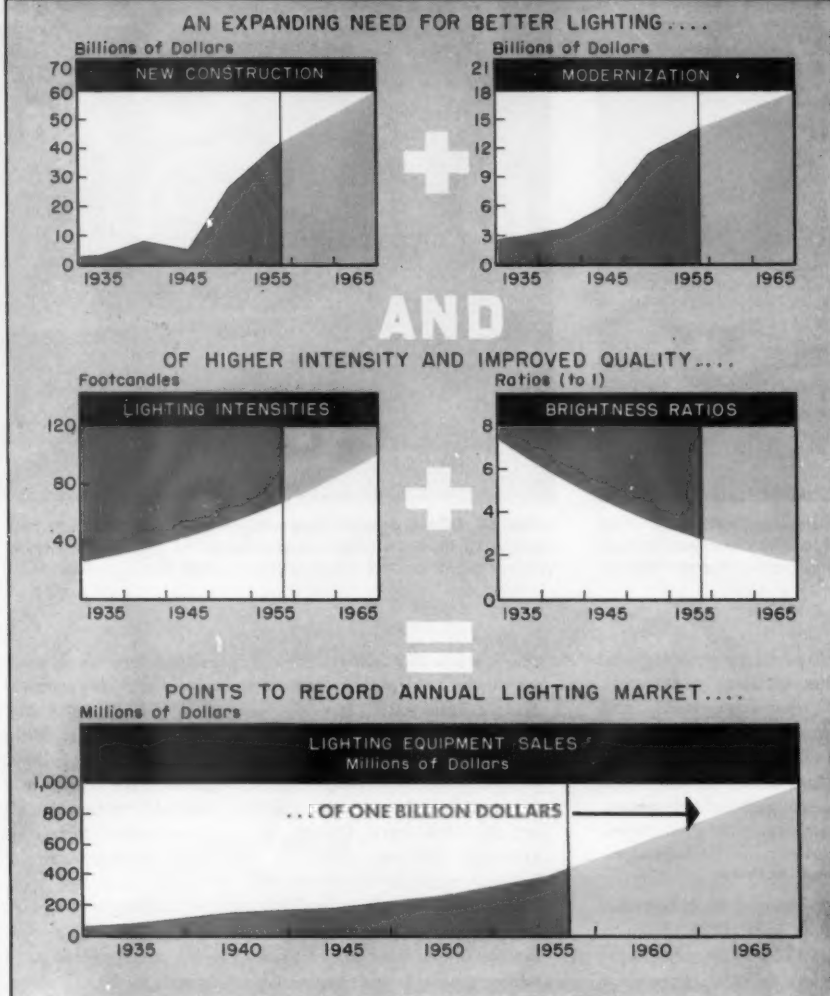
1952 was conservatively estimated at \$5 billion. It is even larger now, as more installations have become obsolete, and as sub-standard lighting jobs on new projects have been made at a faster pace than relighting has eliminated the backlog.

Viewed long-range, the fluorescent lamp, a diffuse type of light source, has had a considerable influence on lighting trends. It has enabled lighting engineers to design lighting systems with more diffusion and light uniformity than was ever possible before. In fact, this characteristic of fluorescent lamps has influenced lighting designers in this direction. The louvered ceiling was the first big development and has been followed by the luminous ceiling representing further refinements.

Not all lighting engineers agree with the lighting principles of the luminous ceiling, especially of the wall-to-wall variety. They think it is monotonous, lacking in design, and lacking in "punch" needed for seeing many critical visual tasks. Others, however, offer a compromise system consisting of large-area, low-brightness panels, made in a variety of sizes and shapes from 2 by 2 panels to 8 by 8 panels, with a feature of being installed side by side to provide a full luminous ceiling.



# Chart II — One Billion Dollars... By 1965



This same trend to low-brightness units to provide a better quality of illumination, has also influenced troffer designs and surface-mounted ceiling unit designs to wider units. Most are 24 in. wide, to match acoustical panel dimensions and typical acoustical grid supports.

Several lighting equipment manufacturers report a trend to integration of lighting systems (luminous ceilings, troffers, recessed incandescents, etc.) with air conditioning equipment, acoustical materials, fire protection devices, etc. and grid-pattern ceiling systems.

While it is impossible to predict specific new developments not yet announced, it is pertinent to note that one large lamp manufacturer has predicted that there will be as many new developments in light sources during the next ten years as has occurred over the past 20 years.

The forecast for lighting sales of a billion dollars in 1965 is made with three assumptions: 1) that there is no shooting war; 2) that there is no major recession or depression; and 3) that the various segments of the lighting industry actively promote lighting sales on a continuing and effective basis. Four lighting promotion programs are now in operation, and it is assumed that these, or similar programs, will be continued. These are:

1. *Certified Lighting Program*—Sponsored by the National Electrical Manufacturers Association. It is now in operation in 11 cities, is planned for many others.

2. *Residential Lighting Program*—Sponsored by the American Home Lighting Institute.

3. *Planned Lighting Program*—Sponsored by the Edison Electric Institute. Used by utility companies.

4. *Better Light—Better Sight Program*—Sponsored by EEI and lamp companies.

Lighting sales in 1965 can and should total \$1 billion. This is based on a volume of \$732 million of lighting for new construction (Table I), and \$268 million of lighting for modernization. This volume for new construction will be realized if new construction work continues to increase at a moderate pace, and the lighting industry maintains a normal growth rate for lighting quality and standards. The lighting volume for modernization will be realized if electrical contractors, trained through the Certified Lighting Program and other industry promotion activities, adopt vigorous sales programs of their own with effective follow-up, and have the conscientious and effective backing of all other segments of the lighting industry.



## ● light for stores



**DIGNIFIED DECOR** prevails in fruit shop, where indirect fluorescent from pierced metal troughs gives low level diffuse lighting and ceiling-recessed R-lamps highlight merchandise.



**LIGHTED DOME** provides general lighting, and recessed incandescent units put light on display cases. Dome uses cold cathode tubes in three colors, dimmer controlled.

**A**N INCREASING standard of living, a growing and shifting population, and higher incomes are factors which keep the demand for consumer goods and services on the increase. This increasing demand, in turn, encourages investment in new stores, restaurants and garages—including retail stores and shops of all types, cafes, diners, night clubs, taverns, etc., and public garages and auto service stations.

### **New Store Construction Activity**

New construction of retail and service facilities has grown spectacularly since 1935 (Chart III), from a \$136-million annual rate in 1935 to an estimated \$1.8-billion total for this year. As late as 1950, the annual rate was only \$886 million, which means an increase of nearly a billion dollars a year in a brief span of only five years.

It is estimated that new store construction will continue to expand over the next ten years, but at a somewhat reduced rate. The forecast for 1960 is an annual rate of \$2.25 billion, and for 1965 an annual rate of \$2.5 billion.

Modernization of stores, restaurants, and garages of all types is expected to continue at a healthy pace. Relighting will constitute the total modernization work in many cases, and will be a sizable part of it in most other cases. Store lighting systems become outdated quickly—about every five to seven years—so that even the new stores now being built will become relighting prospects during the next decade.

### **Current Store Lighting Practice**

Through the years practically every lighting method developed for any lighting purpose has been used to light some store or specialty shop, or some special display area in them. Whether this is the result of the wide scope of architectural and structural treatments encountered, lack of suitable lighting units at hand when needed, or merely the desire to use something "different", is

not known. But out of these experiences has come some sound store lighting practices which are now widely accepted and used.

Store lighting still embraces a broad range of lighting systems and techniques. Some stores, such as high style women's specialty shops, call for conservative charm and dramatic subtlety in the lighting, attuned to the special artistic decor used. Others, such as hardware stores, for example, call for simplicity and high efficiency in the lighting system.

Common objectives in lighting for all types of stores include general illumination for utility, enabling customers to see how to get around to all parts of the store with ease and safety, and highlighting of the displays, to attract the attention of the customers. Further, the lighting system must have a good appearance, it must provide a good color quality light so that merchandise looks as natural and normal as possible, and it must be flexible in layout to permit rearrangement of lighting effects for new display arrangements which are made quite frequently in many types of stores.

Fluorescent lamps are used primarily to provide general lighting, and for lighting floor and wall display cases. However, incandescent lamps still remain highly popular and the preferred light source for many types of stores, and especially for highlighting displays and for spectacular lighting attention-getting color lighting effects.

### **Lighting Trends**

Trends in store lighting are to still higher levels of illumination, to improved color quality and, in the opinion of many lighting specialists, "to more dramatic lighting effects—hence, to more incandescent."

Reflector lamps continue to be popular. But they will be more adequately shielded in future applications, which will also spur the use of standard reflectors used in conjunction with prismatic and diffusing lenses, louvers, etc., and standard incandescent lamps.

More luminous ceilings, and large-area low-brightness





**COMBINATION** of fluorescent and incandescent luminaires provide high level of diffused and display light of good color quality throughout this camera shop.



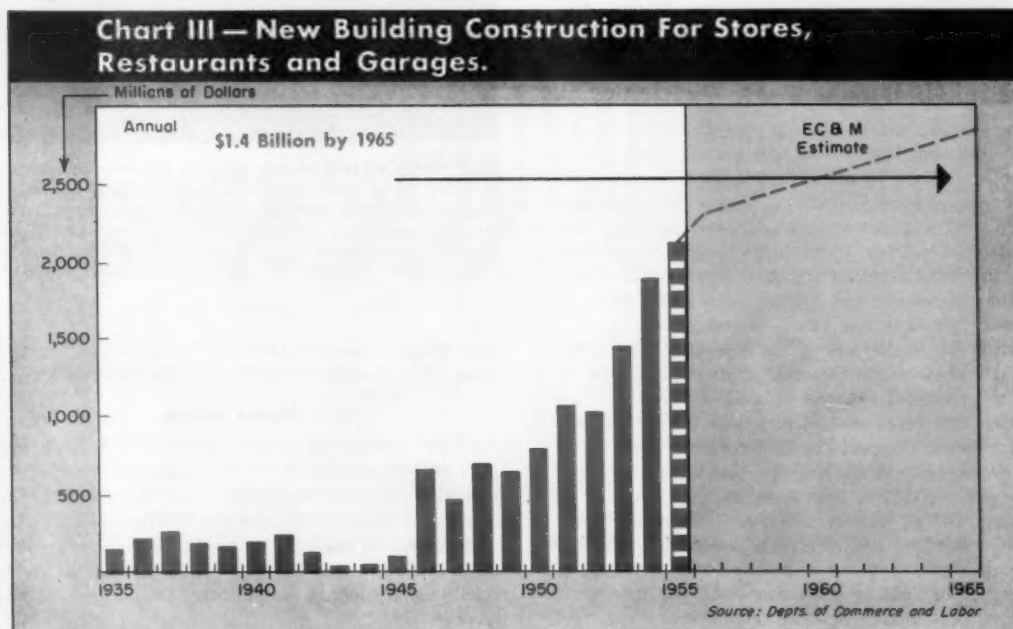
**INCANDESCENT** luminaires put 75 footcandles on merchandise, and 25 footcandles of general lighting over entire area in this women's specialty store.

panels, equipped with deluxe fluorescent lamps for better color quality, will increase in use, and these will be better integrated with architectural and structural details. There will also be an increasing use of removable modular panels containing lighting elements for use in grid T-bar suspended ceilings, to provide greater lighting flexibility for changing display arrangements.

#### Market Outlook

While it is predicted that construction of new stores and restaurants will slow down over the next ten years,

it is expected that store lighting dollar volume will continue at a healthy pace. The 1955 estimated volume is \$63 million, up some 75% over the 1950 annual rate (Table I). Total volume for lighting in 1960 is forecast at \$92 million, up 46% from this year's peak, and at \$125 million for 1965, about double the current rate. The use of better lighting systems, to provide higher lighting levels, and better quality light, as well as more spectacular and decorative lighting effects, including color lighting circuits with dimmer control, are expected to bring about this increase.





## ● light for offices

**O**FFICE lighting techniques are well advanced. They embrace many of the best and most advanced ideas and methods in the art and science of lighting. They provide high levels of illumination of excellent quality, for any and all types of buildings—uniform, shadowless, and free from glare and annoying reflections. These techniques cover a broad range of light sources, equipments, systems, and design and application methods.

Office lighting progress is readily understandable. Much of the basic research in lighting, to determine what type and quality of lighting is most desirable, has been carried on through study of typical seeing problems normally found in offices. This research has pointed up the need for a good visual environment, involving far more than the selection and placement of lighting equipment. It has been found that visual environment involves architectural and structural design, interior decoration, selection and placement of office furniture and machines, and color and finish of all interior surfaces, as well as the selection and integration of a suitable lighting system with these other factors.

### Office Lighting Standards

Continuing efforts to develop a perfect lighting system in an ideal lighting environment have spurred the use of a wide range of types and varieties of lighting equipments, both singly and in combination. Out of this has evolved certain standards and accepted practices, which have been formulated into "Recommended Practices for Office Lighting" by the Illuminating Engineering Society. These recommendations involve principally levels of illumination and brightness ratios. The intensities range from 30 to 100 footcandles, in general, depending on the severity of the visual tasks, with brightness ratios not exceeding a 3-to-1 range from the brightness of the visual task.

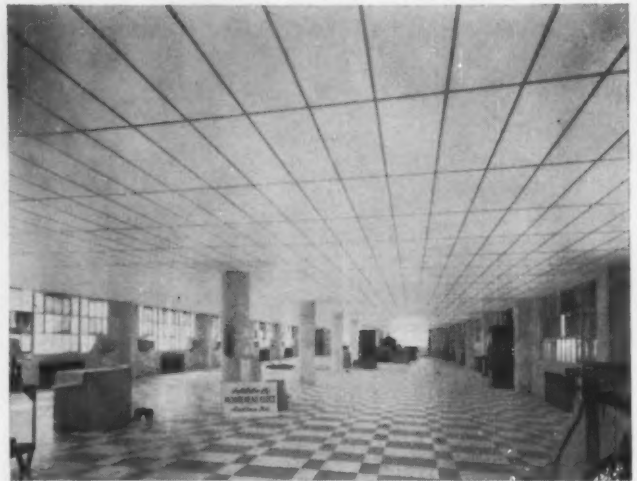
Some of today's more or less popular lighting systems for offices include: translighted (luminous) ceilings, luminous indirect pendant luminaires, recessed troffers, louvered direct-indirect pendant luminaires, louvered surface-mounted luminaires, and louvered or diffuser equipped recessed incandescent units.

### Lighting Trends

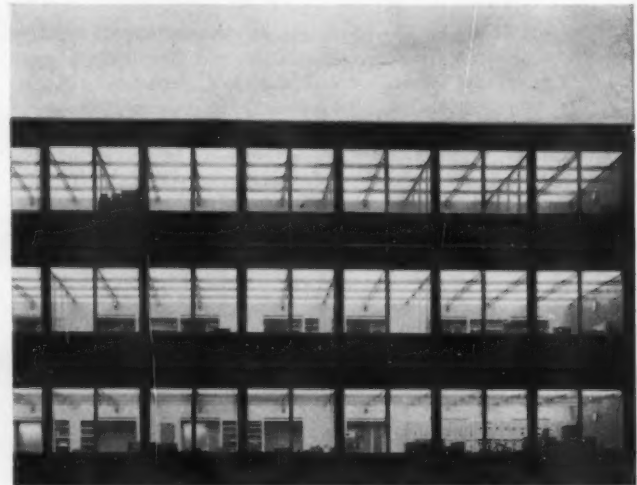
Looking ahead, office lighting objectives are much higher illumination levels, and still greater seeing comfort. Also, objectives include a better color quality light, and higher lighting efficiencies. It is expected that these will be achieved, with refinements of current lighting techniques, methods and equipments contributing extensively.

Significant office lighting trends, many of which will develop into standards and expand into other fields of lighting over the next few years, include:

- Integration of sound and climatic control and other mechanical and electrical systems, as may be desired or required, with various types of lighting systems.
- Expansion and refinement of luminous ceiling lighting systems for better appearance, incorporating more flexibility, more elements of good design, and a wider variety of panel patterns, shapes, and materials.
- Increasing use of troffers and surface-mounted units which are wider and shallower, for low-ceilinged areas.
- Development and adoption of basic modular dimensions for most types of lighting equipments and luminaires.
- Combining of direct lighting equipments, such as



**PLASTIC LOUVER** panels form translighted ceiling in former warehouse area, provides 200 footcandles of highly comfortable lighting for a new 10,320 sq ft drafting room.



**ELECTRIC CEILING** in this 60-ft by 690-ft three-story office building is an architectural element, provides light, sound control, air distribution, fire protection, and rigid grid for flexible partitioning of offices. Use of T17 40-watt 60-in. low brightness fluorescent lamp set module at five feet, for acoustical baffles or partitions, which are interchangeable.

troffers and recessed-louvered incandescent units, with trans-lighted ceilings for higher illumination levels.

### Market Outlook

Office lighting sales have increased 150% during the past five years. (Table I). Estimate for 1960 is for an increase of 29% over 1955, and for 1965 a further increase of about 39% over the 1960 rate. This assumes a slowdown in the rate of new office building construction, but a gradual increase in the cost of lighting per construction dollar as lighting standards continue to increase.

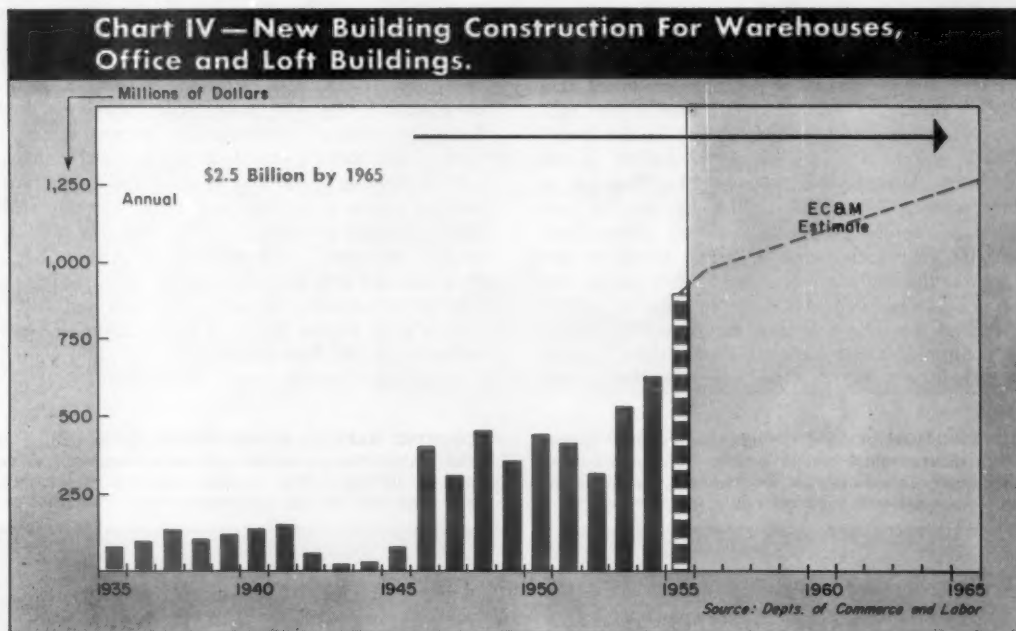




**RECESSED TROFFERS** with double Fresnel type lens panels maintain 60 footcandles in this record room of a large office building, controls light distribution, and eliminates glare.



**WIDE TROFFERS** are growing in popularity, and provide high intensity with low brightness as in this office area lighted by 24-in. wide units recessed in grid type ceiling.



Construction of new office buildings, which here includes banks, savings and loan associations, warehouses, loft and insurance buildings (Dept. of Commerce classification), has expanded rapidly since 1949 (Chart IV), and has more than doubled in the past four years. Prior to 1946, when volume hit a \$309-million annual rate, it had coasted along for about 15 years, through the depression and war period, at an annual average of less than \$100-million. This year's total is estimated at over \$1-billion, or more than ten times the pre-1946 average rate. This new construction provides a growing potential for lighting equipment sales.

Some of the best office lighting installations have been made in old buildings, under modernization programs. Paradoxically, lighting installed in many of the new post-war buildings is substandard. These new buildings are already prospects for relighting. Explanation is that new buildings have put emphasis on air conditioning, new high speed elevators, sound control, modular furniture layouts, and similar modern conveniences. To compete, older buildings have found that investment in good lighting and painting has had additional tenant appeal, whereas investment in these other services merely brought them in line with competitors.



## ● light for schools

**S**CHOOL lighting now faces a probable record breaking expansion which may be even more spectacular than that of the fluorescent lamp when it was first introduced. Now at a record peak of about \$75 million annually, or some 18% of total lighting sales for 1955, school lighting is in for a predicted 190% increase over the next ten years (Table I). The estimates for lighting in new schools only are \$69.65 million this year, and \$163.3 million in 1965. The balance would be for relighting of existing schools.

### More Classrooms Urgently Needed

One of the nation's most serious problems today, as has been well publicized by press, radio and TV, is its school-housing shortage. This shortage has been brought about by a combination of factors—depression, two wars, high birth rate, population mobility, inadequate financing, lack of long-range planning and lack of capital expenditures for new schools.

Going back for 20 years (Chart V), it can be seen that the highest annual rate for new school construction before 1947 was only \$455 million, in 1939. It dropped as low as \$51 million in 1944 when all new building construction was under government control during World War II.

The increase in number of students each year is pointedly stressing the classroom shortage. Enrollment this fall was 39.5 million, or 1,657,000 more than a year ago, up 4.38%. It is estimated that enrollment in the school year 1964-65 will be 51.5 million, up 12 million in the next nine years. Of today's enrollment, 29 million are in elementary schools, 7.7 million are in high schools, and 2.8 million in universities, colleges, and professional schools. Last year there were 4,060,000 births in the United States, the highest on record, which means the annual need for classrooms will keep on growing.

The potential for school lighting is expanding rapidly for four main reasons: 1) capital expenditures needed for new schools over the next ten years are for a rate

about 2.6 times that for the past ten years; 2) nearly all existing classrooms need relighting; 3) current standards for school lighting are too low; and 4) the ratio of "cost of lighting equipment" to "total cost of new school construction" should and will continue to increase.

Currently available classrooms, according to a recent survey by *Engineering News-Record*, are 1,045,000, of which 196,000 are to be abandoned in the next four years. New classrooms needed by 1959 total 476,000. This gives an increase of 280,000 classrooms, or a total of 1,325,000.

School construction needs as estimated by the U. S. Office of Education and reported by Dept. of Commerce will total \$41.5 billion (Chart V) by 1965, of which about \$31 billion will be needed for increased capacity and replacement of elementary and secondary schools, and \$10.5 billion will be required for college and university building construction.

### Current Lighting Practice

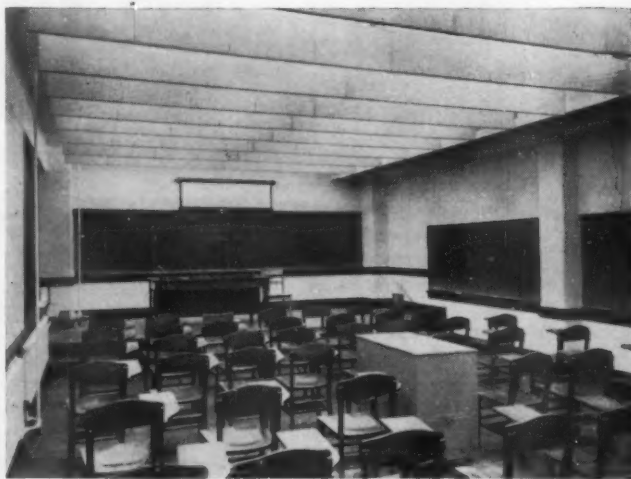
The lighting industry has for several years given high priority to research and study of school lighting problems. As a result, lighting practices have been pretty well standardized, and approved by American Standards Association and the Illuminating Engineering Society. These standards set forth "minimum" requirements for illumination levels in various areas of a school, and "maximum" brightness ratios for insuring a good visual environment. As with many other standards, however, these "minimums" automatically become design objectives. Thus today's standards are considered *too low*.

With lighting levels and lighting quality continuing to rise year after year, and now being forecast at 100 to 200 footcandles generally by 1965, certainly the "30 footcandles minimum" recommended by ASA—IES is not adequate, and is a poor investment for a modern school. The major problem, however, has been and still is one of producing higher levels of illumination efficiently, on the order of 100 footcandles and above, and maintaining a desired comfortable visual environment.

**EVEN DISTRIBUTION** of light throughout classroom is provided by corrugated vinyl plastic ceiling. V-shaped baffles keep room quiet, shield ceiling. Provides good solution for relighting old schools with high ceilings.



**ACOUSTIC Baffles** installed vertically on ceiling control noise, shield fluorescent lamps surface-mounted on ceiling between baffles. This system reduces maintenance, is easily installed in old classrooms.





### Lighting Trends

The architectural trend to lower ceilings will influence school lighting system design. Already there is a trend to troffers and surface-mounted luminaires, principally of the large-area, low-brightness types, to meet this problem. Fluorescent lighting will continue to grow in popularity, but there is still a sizable demand for incandescent lighting, principally for indirect units where intensities of 25-30 footcandles are considered adequate.

Use of luminous ceilings in classrooms is growing. In wall-to-wall, and in large panel sections, it will be used in new construction and in modernization of old schools. A new "floating" luminous ceiling which does not extend to the four walls, but conceals the lamps, wiring channels, the old ceilings, pipes, beams, etc., has recently been announced. It is intended primarily for relighting where ceilings are high. Of interest to lighting men is the fact it costs about twice that of a conventional fluorescent system, yet saves the school a total capital investment of approximately one-third.

Other trends include better design luminaires, better shielding in the critical 60-to-90 degree zone, better maintenance features, and systems which will use higher light output lamps. One manufacturer predicts recessed troffers will be recessed in low-brightness luminous ceilings for comfortable higher intensities.

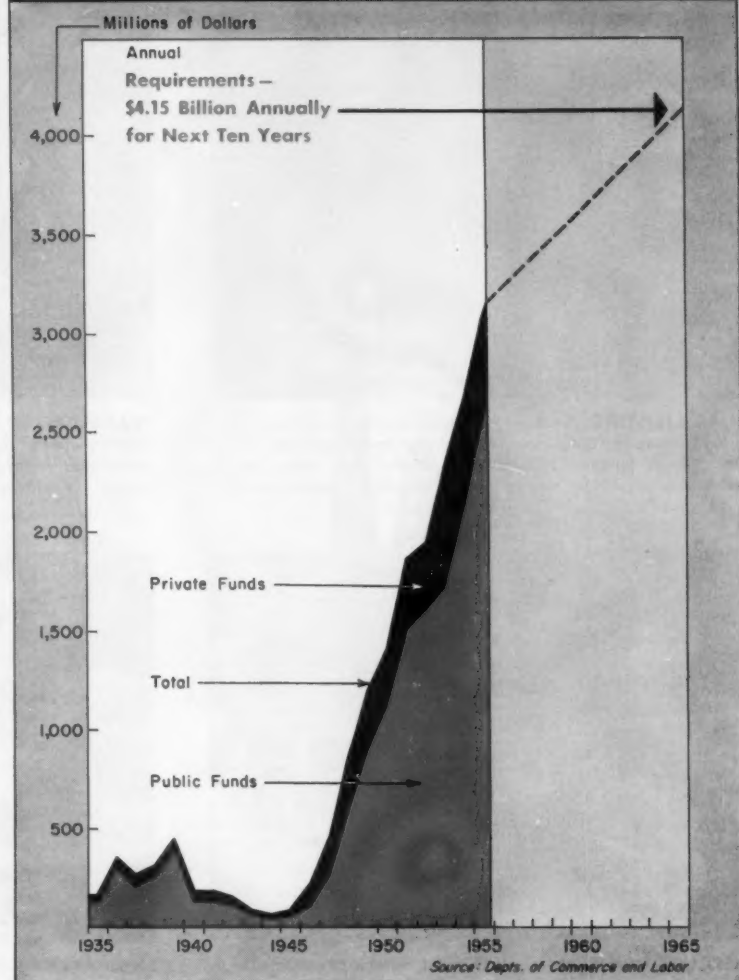
**LOW BRIGHTNESS TROFFERS** using T17 40-watt 60-in. fluorescent lamps provide ideal solution to problem of lighting classrooms with low ceilings, permit high levels of illumination without direct or reflected glare.



**MODERNIZATION** of old school buildings provides up-to-date facilities at low cost. This high school auditorium in attractive classic architectural design was economically and efficiently relighted with recessed downlights in ceiling.



Chart V — New School Construction





## ● *light for industry*



**DUAL LIGHTING** in this large machine press area is provided by twin mercury-incandescent aluminum high bay luminaires which deliver 42 footcandles to the work area. Seeing conditions could be improved by providing some up-light.



**TRANSLIGHTED CEILING** provides shadowless illumination for this control room, is being used to light many industrial production areas where high intensity well diffused light is needed for critical seeing.



**MERCURY LAMPS** in large industrial reflectors produce high level lighting economically and efficiently for medium and high bay areas, afford excellent visual acuity in metalworking plants. Lighted ceiling improves visual environment.



**SHADOWLESS** lighting on intricate assembly production line is provided in this plant with special large-area continuous luminaire which produces 240 footcandles on the work. Continuous row reflectors on ceiling provide general lighting.



**UPWARD COMPONENT** of lighting from continuous row luminaires lights ceiling softly, eliminates harsh contrast of lighted unit against dark ceiling. This is typical of trend to make seeing as comfortable as possible.



**HIGH INTENSITY** of 100 footcandles average is provided in this drafting room, by continuous row 4-lamp louvered units installed on 8-ft centers, 18 ft above the floor. Upward component lights ceiling softly.



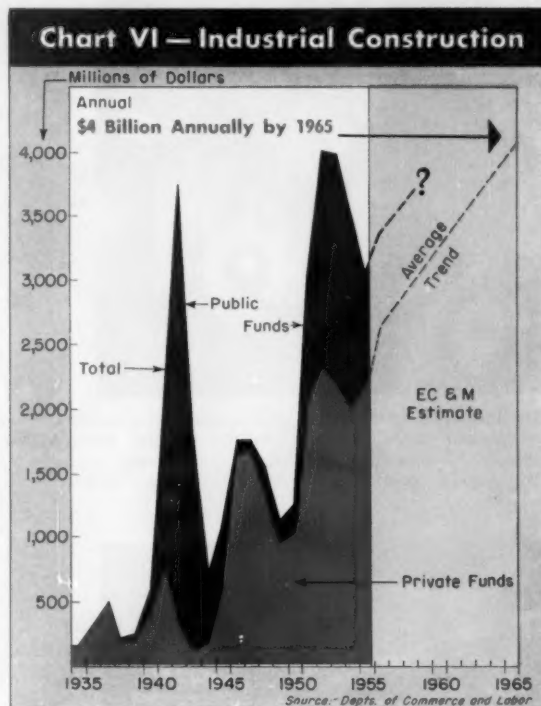
**T**ODAY'S industrial lighting standards and practices include:

- Lighting intensities of from 30 to 100 footcandles for most production areas, depending on the criticalness of the seeing tasks.
- From 10 to 40% upward component of light from luminaires, to light the ceiling softly, reduce brightness contrast between the lighted luminaire and its background, and to create a more comfortable seeing environment.
- Direct shielding of lamps and reflectors to at least 25%, preferably more.
- Use of fluorescent lamps for low bay lighting, of fluorescent, mercury vapor and incandescent light sources for medium and high bay areas.
- Use of apertured industrial reflectors in continuous row or grid pattern layouts.
- Use of recessed fluorescent troffers in low-ceilinged, air conditioned production areas, and even of translighted ceilings with acoustical baffles in some cases.
- Expanding use of color-improved mercury lamps and reflectors for medium and high bay areas.
- Use of R-lamps in areas where maintenance is difficult or only low intensities are required.
- A growing use of larger light output fluorescent lamps wherever possible, such as the 800 ma rapid start T12 lamps and 85-watt T17 lamps.

#### Lighting Trends

Based on the types of lighting systems being installed in today's new plants, industrial lighting standards will continue to rise. The trend is definitely to more light for production areas, and to better quality lighting—free from glare and wide variations in brightnesses. And factories which are adopting automation in any degree are installing better lighting, with even higher standards, than those plants still depending upon employee control of machines and processes. It is believed that automation will boost the need and use of more highly skilled labor—engineers, draftsmen, supervisors, troubleshooters, and maintenance men—and that good illumination will be more important than ever. So automation should not, as some lighting engineers have questioned, reduce either the quantity or the quality of industrial plant lighting.

The trend is to higher levels of illumination, and intensities of 100 to 200 footcandles and above are on the way. More attention will be given to the entire visual environment. Air conditioning and sound control will be used to greater extent in production areas, and all building interior and machine surfaces will be finished in lighter colors of non-specular finish. Luminous ceilings, wide recessed troffers, and large-area, low-brightness lighting concepts will be adopted for more and more production areas. Local lighting units, which will tend to become larger in size and lower in brightness, will provide exceptionally high levels of illumination for inspection, close tolerance machining operations, etc. where critical seeing may be necessary. Light sources will be made more efficient, in larger sizes with higher light output per lamp, for industrial lighting applications. Also, luminaires will be better shielded, designed for easier maintenance, stronger, and with apertures for directing more light upward to the ceiling. It is further expected that high frequency operation of fluorescent



lamps will be adopted for many industrial high bay and large area lighting applications, and used in large multi-lamp luminaires specifically designed to properly control the light output of the brighter and more efficient lamps.

#### Market Outlook

It is estimated that industrial lighting accounts for some 20 to 25% of today's total lighting sales, and that some 80% or more of this is for lighting new factories.

The construction of new industrial plants, a good barometer for industrial lighting sales, hit a peak in 1952, then declined during the following two years. In 1952, 42% of industrial construction was with public funds, principally for atomic energy and defense plant facilities, and climbed to about 45% in 1953. Since then the ratio of public-to-private spending has been dropping (Chart VI). And beginning in 1955, private industrial building has again started to climb. It is expected to continue, but at a faster pace, according to recent surveys, and will reach an estimated \$4-billion annual rate by 1965.

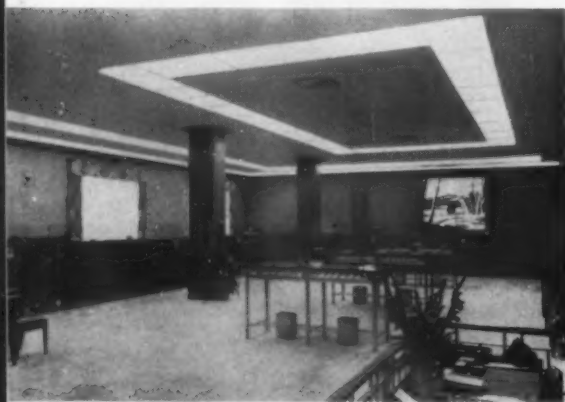
With the demand for higher lighting intensities and for a much better quality of illumination increasing generally, a growing percentage of the new building construction dollar may be expected to go into lighting. Thus, with an estimated sales volume of \$70.5-million for new plant lighting in 1955 (Table I), it may be expected that this market will double, to about \$139-million annually, by 1965. The market for relighting old plants will be in addition to the new plant lighting. This relighting volume depends, of course, on how much effort is put into it by electrical contractors, lighting equipment manufacturers, and others in the lighting field.



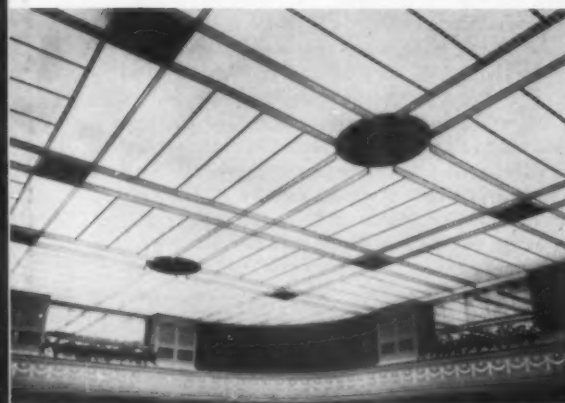
## ● light for institutions



**DECORATIVE LANTERNS** combined with downlights use incandescent lamps to create cheerful lighting effect in this church. All downlights are concealed from view of congregation through careful placement.



**RECESSED TROFFERS** in this bank are 24 inches wide, and self-contained units, installed in continuous rows. They fit the 24-in. acoustical grid pattern exactly. Walls contain trans-lighted color transparencies to give effect of windows.



**SPECTACULAR LIGHTING** effects feature this relighting installation in a club ball room, where 420 40-watt fluorescent lamps in three colors above the corrugated plastic ceiling are dimmer-controlled, provide intensities from 0 to 35 footcandles.

**I**NSTITUTIONAL buildings, such as art museums, banks, churches, libraries, memorial buildings, public auditoriums, etc., have usually been given special consideration for lighting. The older monumental type of buildings were generally of Grecian, Gothic, Colonial or similar classic style of architecture, and were lighted with period design luminaires of the same architectural style. More often than not these luminaires were elaborate examples of expert craftsmanship in metals and glass, but gave very little light. However, they were carefully selected, principally for their appearance, and if the quantity and quality of illumination produced was not too good, it was overlooked.

The emphasis today is on more illumination, of better quality, to provide the best seeing conditions possible. Lighting in modern institutional buildings is still considered an important adjunct and is given special attention. It is usually combined and integrated with the architectural details of the structure, to reflect modern design and to utilize modern materials. Thus it serves its true functional purpose of providing illumination, and achieves its good appearance by becoming part of the architectural pattern and not through its ornateness.

### **Upsurge in Church Building**

New church construction this year is at a \$750 million annual rate (Chart VII), a record, and up sharply from a \$59 million pre-1945 annual high. In only one post-World War II year, 1952, has it failed to increase over the previous year, and construction controls during the Korean war held back construction that year. A constantly growing interest in religion, with church membership increasing at a faster rate than our population, and with a tendency to overcrowding due to a sharp rise in total members per church structure, has increased church spending and building. Also, the present day church building is being used seven days a week, by all age groups, and for an increasing number of purposeful activities and interests. So a new type of structure is called for, requiring new standards for lighting, and a new appraisal of lighting needs.

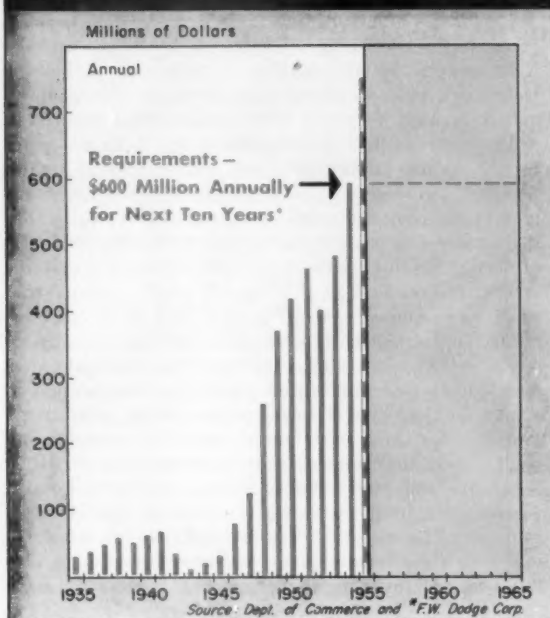
During the next ten years, some 70,000 churches and synagogues will be built, or substantially altered, according to a recent forecast by F. W. Dodge Corporation, at an estimated \$6 billion total cost. Also, there will be about 12,500 other projects involving parish houses, Sunday school rooms and related structures, costing about \$1.25-billion, according to the forecast. These estimated expenditures were considered in preparing the data for Table I.

### **More Hospital Facilities Needed**

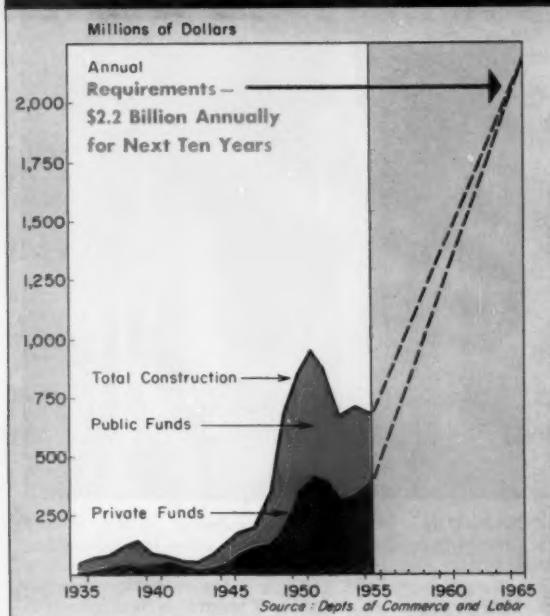
Civilian hospital needs over the next ten years have been estimated at \$21 billion, as reported in State plans to the U. S. Public Health Service. A \$13.5 billion expenditure is needed for the existing backlog of needed hospital construction, and a \$7.5 billion expenditure for needs growing out of obsolescence and population growth during the next decade. Existing beds as of January 1, 1955 were 1,009,000, while requirements for new facilities totaled 838,000 new beds. The increase in needs during the next ten years are estimated at 450,000 additional beds. Another \$1 billion will be needed for health centers, clinics, asylums and similar institutional buildings, bringing the total for new hospital and health facilities over the next ten year period to \$22 billion.



### Chart VII — New Church Construction



### Chart VIII — Hospital Construction



#### Lighting Trends

Lighting in institutional buildings will improve in quantity and quality, more or less the same as in schools and offices, but will also pioneer the way to better equipment design and integration of engineered lighting techniques with building structures and designs.

Traditional design hanging lanterns will continue to be used in many traditional Gothic and Colonial style churches, but for artistic treatment and appearance more than for providing utilitarian light. More efficient types of lighting units may be expected to be used, recessed or hidden from view generally, to provide light for seeing.

Hospital operating rooms will continue to be lighted by special optical systems or multi-lens systems which will provide shadowless illumination of high intensity (up to 2000 footcandles) over the small operating area, using special filters to remove excessive heat. Refinements in lighting of wards and private rooms will provide more comfortable lighting for reading in bed.

#### Market Outlook

The market for lighting in new churches should develop about as forecast (Chart VII and Table I), barring a depression or war emergency. Also, church relighting should be an active field over the next ten years.

The lighting market potential in new hospital construction can develop only as fast as the new construction goes ahead. Financing is a problem, with Federal assistance available to State and local governments on a matching basis. Ready-to-go projects, with plans and specifications completed, are not adequate to boost 1956 construction very far beyond the 1955 annual rate. But the need exists, and pressure will increase to get this program going.



**RECESSED DOWNLIGHTS** in ceiling are combined with indirect light from two ornamental suspension luminaires to provide 42 footcandles at tellers' cages in this high-ceilinged bank, and is a typical relighting technique for old banks.



## ● exterior lighting



**FLOODLIGHTING** of buildings, monuments, towers, theatre and store fronts, etc., in white and color has advertising value, creates civic pride, provides beauty and decoration to communities where used. Lighting intensity on Los Angeles church spire increases with height so top is four times as bright as base.



**LUMINOUS SECTION** three stories high caps tall building in New York City, contains green cold cathode lamps on inside for quick identification, is typical of expanding use of light for advertising and quick identification.

**T**HE market potential for exterior lighting has been growing larger and larger, year after year. It embraces a surprisingly broad scope of lighting subjects, and a wide range of luminaires, equipments, and light sources. It also embraces a multitude of lighting techniques and specialized fields of applications, all requiring a high degree of skill and technical know-how.

The scope of the market includes, but is by no means limited to the following: street and highway lighting; floodlighting—buildings, monuments, sports (major and minor), construction work, industrial and railway yards, spectacular and color lighting, golf driving ranges, etc; protective lighting; parking lot, used car lot, and gasoline service station lighting; swimming pools; airport runways, and terminal building aprons; and many others.

Lighting equipment for outdoor lighting applications is also varied, and includes the following principal types: floodlights—open and closed types, explosion-proof and watertight types; street and highway lighting units; PAR lamps, clear and with color roundels; searchlights; pump island and fluorescent-column type units; special decorative and garden lighting units and devices; wall-recessed lens units for special asymmetric light distribution, etc. The majority of these units are designed for use with incandescent lamps; however, many are also being adapted for use with mercury and fluorescent lamps.

### **Lighting Trends**

The floodlighting of buildings, monuments, and similar structures, a popular means of conservative advertising some 25 years ago, is expected to be resumed again over the next ten years in greatly expanded form. More elaborate effects are now possible, especially in the field of mobile color lighting, and these will receive greater consideration from lighting engineers, architects, builders, promotion-minded realtors and advertising men.

The incandescent lamp will continue to be the favored light source for exterior lighting problems which require specific and accurate control of the light. Compact point source filaments permit exacting control of light by reflectors and lenses, for a variety of beam patterns. Such control can be used effectively for most floodlighting applications, such as to reveal the true textures and colors of buildings, to eliminate spill light in unwanted areas, to increase lighting efficiency by putting more light where needed, and in many other ways.

Floodlights with greater light output may be expected, for producing higher intensities with less units. Life of floodlight lamps may be expected to be increased, and maintenance minimized. PAR lamps, with their variety of sizes and beam patterns, will be used more extensively and for an increasing number of applications.

Floodlights and other types of exterior lighting devices will be better integrated with architectural details, at the time a project is being designed, and adequate mounting locations with improved focusing angles will be provided. These will permit better lighting results and effects.

Street lighting luminaires, already being used for many outdoor lighting applications, will be used for a greater variety of commercial and industrial lighting problems.

Mercury lamps, especially the new color-improved type, will increase in use both in floodlights and street light-



ing luminaires. These will be used for distinctive appearance on some jobs, combined with incandescent units on others where color quality of the light is a critical factor.

Fluorescent lamps will be used in new and improved street lighting luminaires, of which there are already some good designs, on a continuing variety of applications—street lighting, shopping center parking areas, and similar areas where a diffuse, uniform level of lighting is desired.

#### More Highways Needed

The \$101-billion, 10-year highway program which President Eisenhower proposed to the 84th Congress earlier this year, based on the report of his Advisory Committee on a National Highway Program, represents well over four times the \$21 billion invested by all levels of government during the past 10 years, when highway construction outlays were greater than for any previous 10-year period. While Congress adjourned without taking action on this program, due to difficulties in agreeing on a method of financing, it is confidently expected that a highway program of the approximate scope and potential of the President's proposed program will be approved in the months ahead.

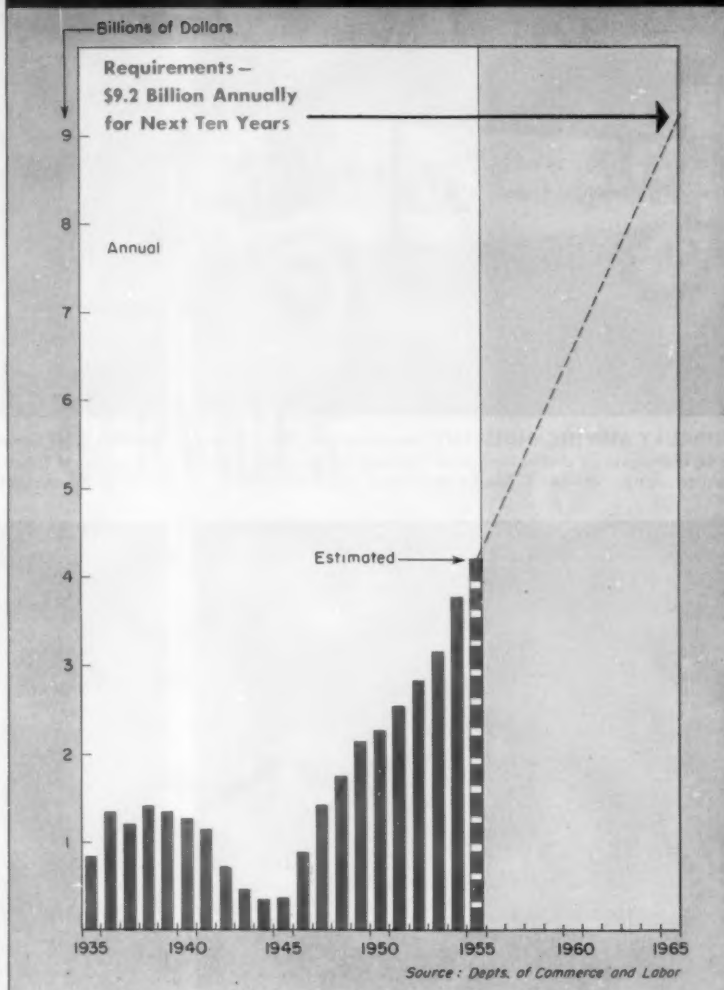
Of the \$101 billion proposed, \$9 billion would be needed for right-of-way and other non-construction costs, leaving \$92 billion for actual highway costs. Construction forecasts in Chart IX include the assumption that this or a similar highway program will be approved, and the construction pace will be stepped up gradually over the next ten year from the current \$4.2 billion to \$10.0 billion in 1965.

#### Market Outlook

The highway program is the big factor in the market outlook for exterior lighting, although there are also many other bright spots. Highway construction carries with it a sizable lighting potential today, for bridges, tunnels, viaducts, toll stations, access roads, crossings, and lanes to roadside restaurants, motels and stands.

In Table I, item 31 shows a lighting market forecast for highways, varying from \$4.41 million this year to \$22.5 million in 1965. This forecast includes the use of lighting for heavily-traveled sections of actual highways, in addition to the usual tunnel and other types of lighting now being used.

### Chart IX — New Highway Construction



FLUORESCENT street lighting luminaires add new concept of high level illumination for city streets, plus uniformity of light and elimination of shadows.





**MERCURY AND INCANDESCENT** lamps are combined to provide high level of distinctive color lighting in gasoline service station. Units at 14-ft height are JH-1 mercury units.



**FLOODLIGHTS** provide 30 footcandles of dignified lighting for this used car lot, which enables quick and thorough inspection of cars by customers.



**MERCURY STREET LIGHTING** luminaires mounted 30 ft above roadway light parking area of typical shopping center. This type equipment is fast growing in popularity.



**FLOODLIGHTS** provide 1.5 to 2.0 footcandles over railroad classification yard to enable tower operators to identify car numbers, prevent vandalism and sabotage.

Such lighting promotes safety, is urgently needed, and this fact is recognized by most highway authorities. So it is believed that the lighting industry can and will promote and sell highway lighting to the extent indicated in the forecast. The potential is of course many times greater.

The exterior lighting market outlook is also rosy in other directions. The growing expansion of suburban shopping centers and super markets opens up more parking areas, more streets and roadways, to be lighted. New homes, designed for more outdoor living, will require outdoor and garden lighting. Shorter work weeks with higher wages is putting more stress on recreational centers, requiring more lighting for night time use. And spectacular color lighting effects, cycled for sequence changing, is expected to develop as the public becomes more conscious of it as an attraction-getter, and as an expression of civic pride on public buildings.

The forecasts on lighting trends on the preceding pages have been condensed from extensive comments and predictions of some of the key lighting authorities from the lamp and lighting equipment fields, including the following: Benjamin Electric Mfg. Co; Century Lighting, Inc; Cold Cathode Lighting Corp; Crouse-Hinds Co; Curtis Lighting, Inc; Edwin F. Guth Co; Electro Silv-A-King Corp; General Electric Co, Lamp Dept; Great Northern Mfg. Corp; Gruber Lighting; Holophane Co, Inc; Leadlight Fixture Co; Lighting Products, Inc; Line Material Co; Litecontrol Corp; Luminous Ceilings, Inc; Mason & Basedow; Metalcraft Products Co, Inc; Mitchell Mfg. Co; Novelty Lighting Corp; Pittsburgh Reflector Co; Rambusch—Lighting Div; Revere Electric Mfg. Co; Rohm & Haas Co; Smoot-Holman Co; Sunbeam Lighting Co; Swivelier Co, Inc; Sylvania Electric Products Inc; The Thompson Electric Co; Wakefield Co; Westinghouse Electric Corp; and Wilnot Castle Company.





**COLONIE HIGH SCHOOL** in upper New York State combines progressive architectural design with excellent power distribution, lighting and audio-visual planning. Capacities of all electrical and physical facilities were conservatively estimated to permit future growth in all services.

# AUDIO-VISUAL SERVICES

## ... for Modern Schools

Facilities for presenting radio, television, sound motion pictures and text-film programs, plus the inclusion of public address and intercom systems, recording and transcribing equipment, telephone service and a variety of other audio-visual signalling devices are now essential components in the design of a progressive educational structure. All of these services, plus an outstanding stage lighting and electrical distribution installation, are features in this pace-setting high school.

By **Edmund G. May**, *Electrical Contractor, Albany, N. Y.*

**D**UE to America's constantly growing population, this nation is now facing the greatest mass-education problem in its history. Already elementary schools are bulging at their seams, placing burdens upon physical structures and teaching personnel alike, and this demand will definitely hit the secondary level of education within the next half-dozen years. It is estimated that the country has a now-existing shortage of at least 700,000 classrooms, representing a potential building program in excess of 26 billion dollars, so it is not surprising that communities, looking into the immediate future, are embarking on unprecedented school-building programs to meet the anticipated educational demands of the decade already starting.

Not only are school structures multiplying in numbers, but they are also

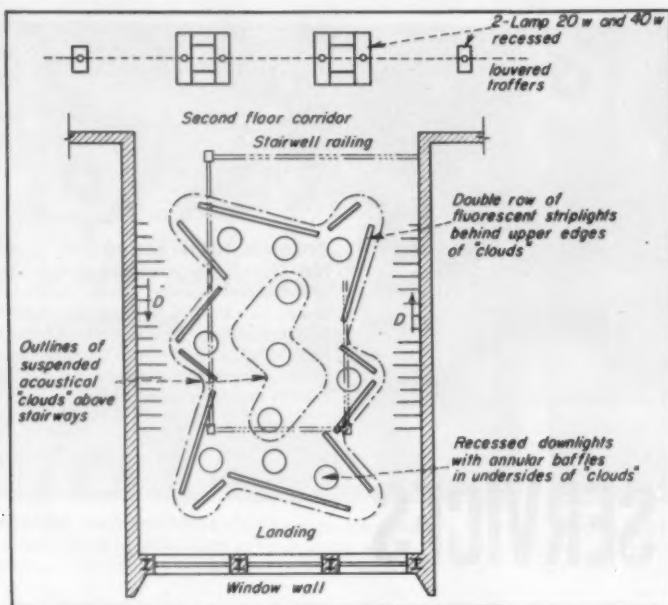
multiplying our former concepts of "adequate" facilities. That is readily apparent by comparing a pre-war electrical specification with its modern counterpart. For example, levels of classroom illumination have climbed steadily; modern power equipment is now synonymous to manual-training shops; cafeteria kitchens and domestic science training rooms are going "all electric"; air conditioning and radiant heating installations are becoming common, while lighting and control provisions in many school auditoriums rival those found in first-rate theatres.

Increased use of audio-visual presentations, both for instruction and entertainment, is likewise demanding greater control and circuiting. This is forcefully evidenced in the up-to-the-minute high school which we are just completing in Colonie, Albany County,



**NIGHT USE OF BUILDING** is extensive, because school facilities are used for numerous adult and civic functions as well. Front entrance and glass-walled stairwell presents interesting pattern of lighting arrangements.





**SUSPENDED ACOUSTICAL CLOUDS** above main stairway are edge-lighted by fluorescent striplights, while downlights illuminate stair treads.

N. Y. There, audio-visual programming is contemplated not only for the auditorium, but for two gymnasiums, the cafeteria, music room and all classrooms as well. And this audio-visual provision is extensive in scope, for facilities anticipate the use of radio and television, text-strip films and sound motion pictures, tape-recording of programs originating within the building, school-wide transcription of both tape and record recordings, plus excellent intercom and phone systems and other signalling devices of a parallel nature. In electrical terms,

these services call for extensive specialized wiring (for power, control and shielded audio use), plus the addition of polarized wall and floor receptacles for recording, projection or sound reproduction equipment.

#### Comprehensive P-A Facilities

Basically the public address system includes a studio-type dual control console unit, a high-fidelity cabinet for the music room, plus four additional control cabinets for use in the auditorium, cafeteria and two gymnasiums. The installation is a 2-channel system pro-

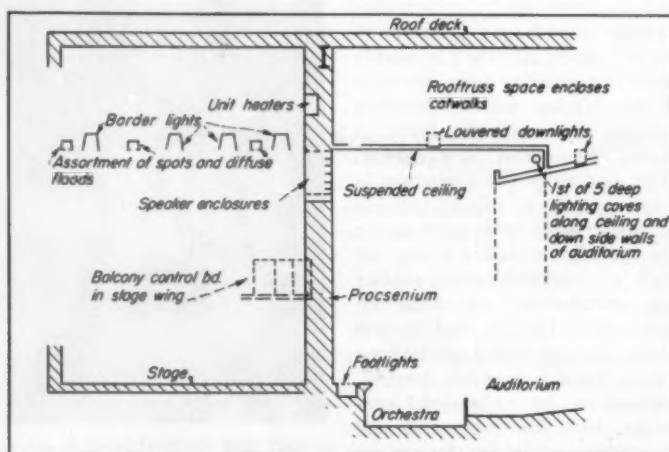


**SOUND CONTROL CONSOLE** is equipped with microphone, radio tuner, tape recorder, record changer, intercom and zone switching panels; permitting reception and transmission of live, recorded or broadcast programs from and to all classrooms and major assembly areas.

viding for the (1) reception of AM and FM radio broadcasts, (2) origination of live or recorded programs at any of the control points, and (3) permanent recording, on tape, of programs either received by radio or originating at any microphone or turntable station within the building.

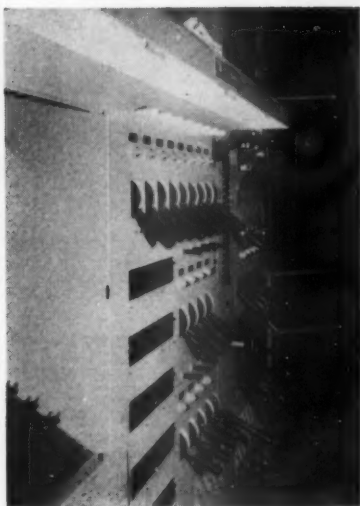
All of these various audio mediums can then be distributed, through the studio console, to any or all loud speakers in the school or, if desired, a program originating at any local control point can be confined to loud speakers located in that same local section of the building. Utilization and regulation of speakers can be controlled either from the local cabinets located in the immediate areas, or from the main studio console. In case of conflicting programs, an all-speaker switch in the studio console takes precedence over local control. Conflicts, however, are not contemplated since telephone communication between all control points should eliminate all operational problems.

Equipment contained in the studio dual-control console includes two high-fidelity AM and FM radio tuners, a hi-fi record turntable, a 4-position speech amplifier, 2-channel booster amplifiers and two 70-watt power amplifiers. The console also includes all related meters, volume controls, input switches, a console microphone and classroom-speaker segregation keys. Control circuits are dc operated.

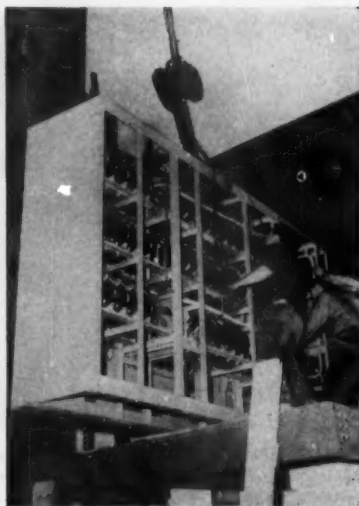


**CROSS SECTION** through proscenium indicates relative positions of balcony control board in stage wing, loud speaker grills, unit heaters, catwalks above suspended ceiling over auditorium, deep lighting coves and variety of down-, foot- and border-lights.





**AUDITORIUM CONTROL BOARD** has 100 separate circuits, 28 dimmers and connected load of 130-kw. Service to board is through four heavy-duty silent-action theatre switches, while distribution within the enclosure is via four main and eight auxiliary bus assemblies.



**CHAIN-HOIST INSTALLATION** of control board on stage-wing balcony was precision job. Minimum clearances between board and stage doorway necessitated use of welding rods as rollers to position assembly beneath hoist rig. Clearance through stage door was  $\frac{1}{4}$ -in.



**STAGE BORDER LIGHTS**, auditorium proscenium units and stage pockets are dimmer-controlled with radiostat auto-transformers. Dimmers may be interlocked so that lamp groups are operable as separate units, complete color groups, or all-inclusive installation.

In the auditorium, the control cabinet contains a 70-watt amplifier, four microphone pre-amplifiers, a variable-speed transcription player, four microphone volume controls and master gain, tape-recorder input and output plugs, plus related power switches with pilot lights. In addition to this console, the auditorium is equipped with two loudspeakers and four mike receptacles in the stage floor.

In the music room, cafeteria and gymnasiums, consoles are similar, with the exception of the number of microphone pre-amps and volume controls. Number of speakers in these areas vary from one (in the music room) to six (in gymnasiums), while microphone receptacles vary from one (in the cafeteria) to six (in the music room).

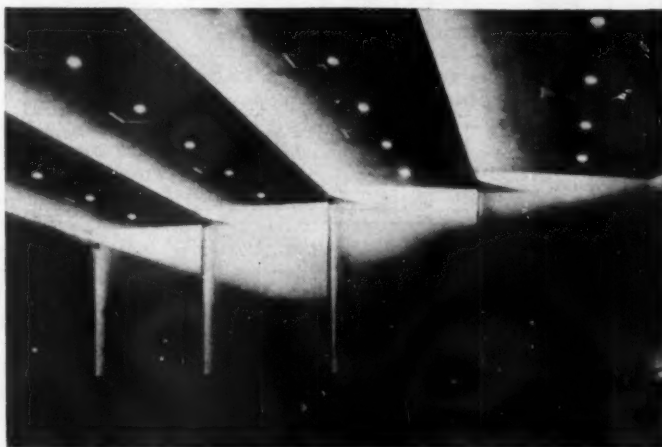
Wiring for this p-a system is extensive, including antenna leads from two roof towers to the studio console, basketweave-shielded twisted-pair speaker cables from control cabinets to speakers, rubber-covered 2-conductor cables between cabinets and each jack and microphone outlet, plus the necessary wiring for the previously-mentioned selective-ring selective-talk intercom telephone system. All wiring is in rigid conduit; all jack outlets are standard telephone type units, and all microphone outlets are flush-mounted 3-pole cannon receptacles. Grounding of this system is via 8-gauge bare

copper wire run in conduit between each junction box and the nearest cold-water pipe.

#### Quality Specifications

Components of the system are all quality products. For example, the 70-watt amplifiers have frequency responses from 20 to 20,000 cycles with a full-output intermodulation distortion below 5%. Phonomechanisms are dynamically-balanced rim-driven ball-bearing units having variable speeds between 20 and 100 rpm, and reversible cartridges for standard and

microgroove records. The tape recorder has a frequency response from 50 to 15,000 cycles; has a 10-watt output; recording speeds of  $7\frac{1}{2}$  and 15 in. per minute, and handles  $10\frac{1}{2}$ -in. reels. Microphones are low-impedance directional velocity ribbon units with 50 to 10,000 cycle response. Auditorium loud speakers are dual tweeter-woofer units with 15-in. bass speakers and 17-in. high-frequency exponential horns housed in flush-type acoustically-lined infinite baffles. And all other speakers are 7-in. accordian cones with 5-watt handling capacities and

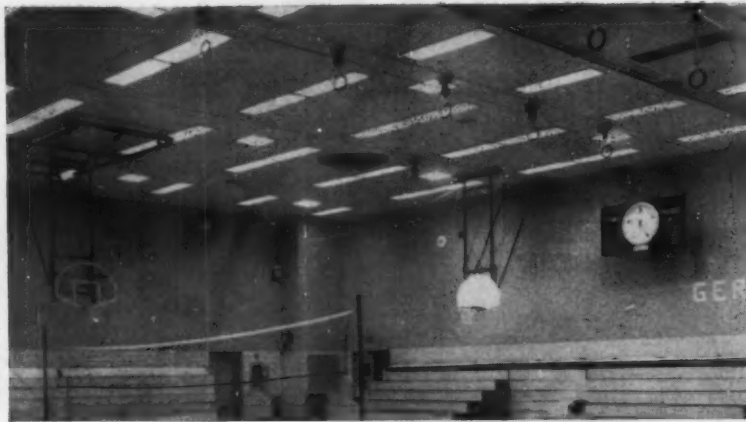


**DEEP LIGHTING COVES** extend across auditorium ceiling and down the sides, while inclined and shielded downlights illuminate aisles and provide adequate lighting for program reference. In events of emergency, all house lights may be activated by magnetic contactors.





**CURVED CORRIDOR**, sweeping around rear of auditorium, is illuminated indirectly by series of cove-lighted acoustical-plastered bays.



**HIGH LEVEL ILLUMINATION** in the order of 115 footcandles is available in the 75- by 100-ft gymnasium, resulting in improved accuracy, speed, player safety and spectator appreciation. Maintenance and relamping of all lighting units is from catwalks located above suspended acoustical ceiling.

acoustic housings matched to speaker characteristics.

#### Wiring for Visual Projection

Inasmuch as visual presentations are keeping pace with audio programs as educational aids, all rooms in the Colonie high school that are equipped for sound are likewise equipped for the projection of slides and motion pictures.

For example, in the auditorium, separate steel conduits carrying 2-conductor basketweave-shielded speaker cables are run between junction boxes

located (1) at the rear of the stage, (2) in the elevated projection booth, and (3) near the center of the auditorium floor—this latter outlet being a waterproofed box. At each of these locations the shielded speaker cables terminate in 3-pole receptacles to which speaker leads may be connected by means of pronged jack plugs. In addition, the control booth is equipped with numerous duplex receptacles for 115/230-volt service, switches connected to remote relays for controlling the house lights, polarized sockets for booth and stage audio outlets, head-

phone jacks of the closed-circuit type for volume control use, plus recessed luminaires for local booth lighting.

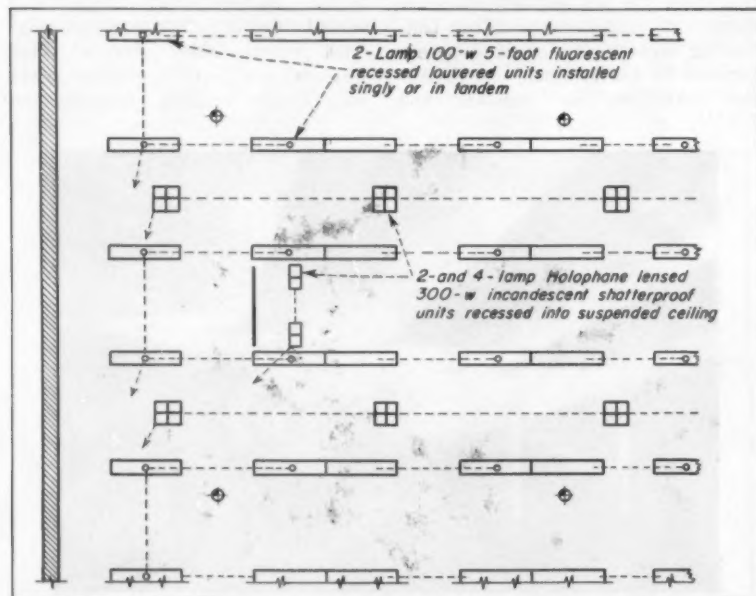
Due to the great depth of the auditorium, incidentally, the angle at which projected pictures strike the motorized screen is less than 8 degrees from the horizontal, resulting in negligible image distortion. Also of interest in connection with visual projection planning are booth facilities for storage of lamps, lenses, film, rewinding and editing equipment. Considerable thought was also devoted to the correct size and type of screen used, acoustical treatment of wall and ceiling surfaces, positioning and proportions of speakers, and location and construction of related equipment brackets, stands and supports.

In rooms other than the auditorium, audio-visual projection facilities include 3-conductor 12-gauge Type T circuits carried in slab-buried conduits between front and rear room audio plug-in outlets, plus the provision of convenient power outlets.

#### Auditorium Has 130-kw Load

While discussing auditorium facilities it is pertinent to mention the lighting and associated control board, for few schools in the country can equal this installation which has a connected load of 130-kw, 100 separate circuits, plus 28 dimmers.

The board is a balcony-mounted free-standing dead-front assembly with all buses, wiring and terminals concealed behind locked, hinged access panels. The unit is a manually-operated pre-set combination board with built-in dimmers, magnetic contactors for auditorium lights, distribu-



**SECTION OF LIGHTING PLAN** of gymnasium shows arrangement and wiring of recessed louvered 2-lamp fluorescent fixtures and Holophane-lensed shatterproof incandescent downlights. Installation has square-foot loading of 7.4 watts and total loading of 55-kw.



tion and branch circuit breakers, plus a receptacle-type plug-and-jack cross-connection panel. Dimmers are accessible from the rear without disturbing general wiring, while breakers and switch mechanisms are removable from the front. The face of the board is illuminated by a sharply-shielded fluorescent strip mounted across the board's top front, and pilot lights marking all switch positions may be quickly replaced without removing cover plates.

The board is also equipped with tumbler switches for the control of individual stage, auditorium, ganged self-closing stage pockets and incidental receptacles, while 23 constant-current circuits serve work-light receptacles and various outlets on the stage and along overhead catwalks.

Service to the board is through four 3-pole heavy-duty silent-action theatre switches, while basic power distribution through the enclosure is via four 100-amp bus assemblies, plus eight auxiliary buses with 8-kw capacities to serve dimmers.

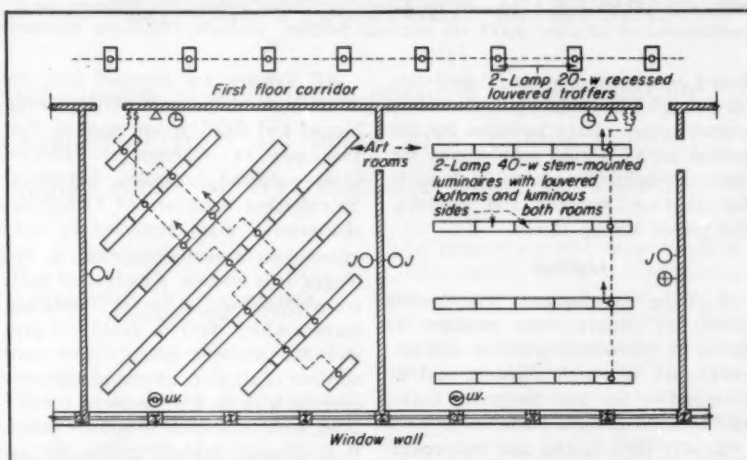
Dimmers control auditorium proscenium, border and stage lights, also all stage pockets. Dimmers are radiostat autotransformer units, interlocked so that they may be operated separately, simultaneously by color groups, or simultaneously on an all-circuit arrangement by means of a slow motion grand master gear wheel.

Dimmers—protected by either 50- or 70-amp breakers and each one equipped with 115 progressive transformer winding contacts—provide for continuous flickerless change in intensity from full brilliance of lights to total black-out. And close voltage regulation prevents the operation of any dimmer from affecting the intensity of lights on other circuits. To insure accurate identification, each dimmer lever is fitted with a colored disc in the end, corresponding to the red, blue or amber lights on the circuit being regulated, while pilot lights above control switches are similarly colored to coincide with the circuits they control. Further identification is provided by contrasting nameplates.

In the event of an emergency and the necessity to restore house lights during a stage presentation, this may be accomplished by activating a "panic control" 2-pole 100-amp magnetic contactor that by-passes all dimming equipment. The 115-volt operating coil of the contactor may be energized from two different pushbutton stations; one located on the control board and the other at the rear of the auditorium.



**NIGHTVIEW THROUGH CLASSROOM WINDOWS** shows two arrangements of stem-mounted louvered-bottom luminous-side fluorescent luminaires mounted in parallel continuous rows. Depending upon row-to-row spacing, classroom illumination varies from 70 to 35 footcandles.



**DIAGONAL ARRANGEMENT** of 2-lamp luminaires, with continuous rows on 5-ft centers, provides shadowless even illumination at 70-fc level to art classrooms and studios. Conventional installation, with luminaires parallel to walls and spacing between rows increased, results in 35-fc average intensity.

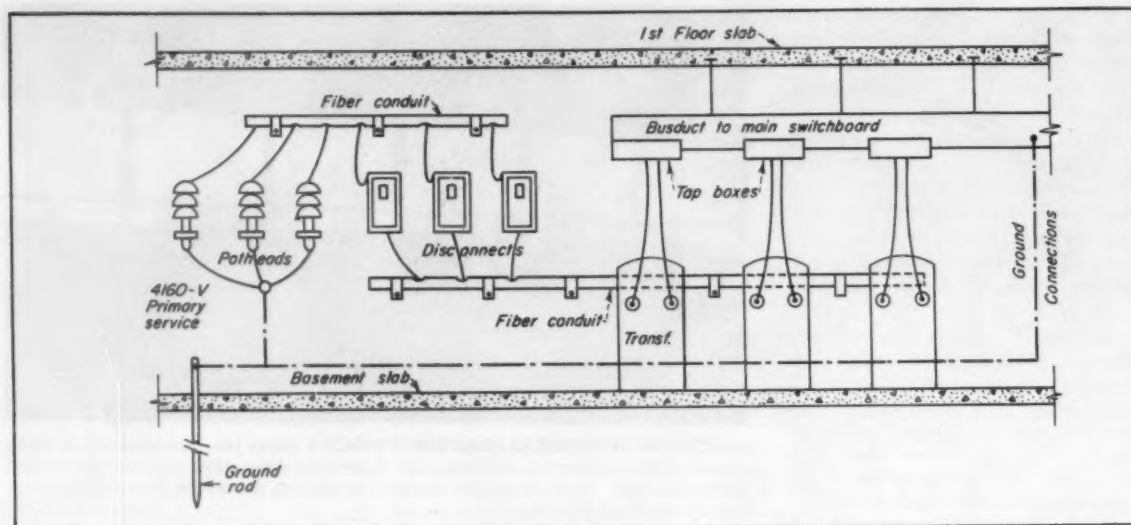
Installation of this board was a precision operation, for the height of the board was 7 ft, which was also the nominal clearance of the stage's exterior door on the loading platform. By sliding the board through the door on welding rods just before the finish flooring was laid, however, a clearance of  $\frac{1}{4}$ -in. was obtained. The metal clad assembly was then raised by chain hoist to the special balcony and skidded into position for final leveling, bolting and wiring. Component electrical loads on the board, incidentally, are 43.7-kw for lights installed in five deep coves running across the ceiling and down each side of the auditorium, 24.3-kw for borderlights, 6.75-kw for footlights, plus 54-kw for overhead spots, stage pockets and special receptacles.

Access to auditorium ceiling coves and spotlight units is by means of catwalks erected along and between the hung-ceiling-supporting roof trusses.

#### Electric Scoreboards

Getting back to the main gymnasium, another audio-visual installation concerns two electric scoreboards, each equipped with a 32-in. timing dial, four banks of 28 lamps (4 lamps wide, 7 lamps high) to indicate the score of basketball games, and four luminous period markers. Boards are completely enclosed, measure approximately 4 by 6 ft in area with a 6-in. depth, obtain power through two No. 10 wires, and are controlled via 30-conductor 16-gauge TW cables in conduit that are paralleled at a press-gallery control board. This control





**PRIMARY SERVICE** at 4160 volts terminates at interior potheads in basement vault. Transformed current is then carried to main switchboard in adjacent vault via enclosed busduct. Separate 1000-amp breakers serve power and lighting sections of board.

board, connected to a special wall outlet through a 30-contact plug assembly, contains four rotary switches for the period lamps, signal pushbuttons for manual operation, and toggle switches for starting, stopping and resetting the period timing clocks.

#### Lighting

Lighting throughout the entire school is progressively modern in terms of intensities, selection and arrangement of visible fixtures, and in imaginative use and design of coves and indirect in-built installations.

Besides deep ceiling and wall coves in the auditorium, already mentioned, various interesting cove treatments illuminate the school's main lobby, corridors and stairways. Stair installations are particularly unique, for there series of irregularly-shaped tiered plaster "clouds" shield fluorescent lamps that deliver interesting patterns in varying light and color intensities to upper walls and ceilings. Direct illumination for stairs is provided by 150-watt downlights recessed into these same clouds.

Another excellent lighting installation is found in the 75- by 100-ft main gymnasium where approximately 40% of the entire ceiling is occupied by fixtures having a gross electrical load of over 55-kw and a sq ft average of 7.4 watts. Slightly over half of this total load is developed by 104 square lensed downlights housing 300-watt medium base incandescent lamps, while the remainder is related to 96 standard industrial RLM fluorescent fixtures, each unit lamped with two 100-watt 5-ft T-17 single pin tubes.

All fixtures are recessed into the 22-ft high suspended ceiling, being hinged and flexibly connected so that they may be relamped and cleaned from overhead catwalks. Lenses of incandescent units are of high-stress shatterproof glass protected by wire guards permanently secured to the hinged lens frames. Fluorescent units are equipped with separate frames and louvers which serve to shield and protect the enclosed lamps. And connections of all units consist of asbestos-covered wire in flexible metal conduit fitted with twist-lock receptacle plugs. With all units lighted, lighting intensities obtained at floor level average 115 footcandles.

In individual classrooms, illumination is generally provided by 2-lamp stem-mounted louvered-bottom luminous-side fluorescent luminaires. Fixtures are generally mounted in continuous rows, and lamped with 40-watt tubes and equipped with rapid-start series-sequence ballasts. Depending upon spacing of rows, intensities on desk tops from artificial lighting alone vary between 35- and 70-fc. This latter figure is obtained in one of the art rooms where rows are on 5-ft centers and are installed at a 45-degree angle to walls. During daylight hours combined artificial and natural light carries intensities well above 100-fc, even on work areas most distantly removed from the continuous windows.

#### Distribution

Primary service to this progressive high school building is underground at 4160 volts via VCL cables carried 24 in. below ground level in 4-in. gal-

vanized conduit to the transformer vault. There voltage is stepped directly to 120/208, with the 4-wire 3-phase secondary being carried to the main 2000-amp switchboard via ventilated low-impedance busduct.

The main board is segregated into a power and a lighting section, each equipped with a separate 1000-amp breaker having a 50,000-amp IC. Local control is from 24 panelboards strategically scattered through the building: 16 of them being devoted exclusively to lighting; two 400-amp power panels being related to air supply and exhaust, heating and ventilation units, unit heaters, circulators, sump pumps and air conditioning equipment; another panel located in the "home making" center to serve electric ranges, driers and appliances; three located in the school's modern shops where lathes, saws, joiners, kilns and other power loads are concentrated; another panel being devoted exclusively to welding equipment, and the last panel serving the school's kitchen where facilities include 25-kw ranges and a 20-kw oven in addition to electric vegetable kettles, peelers, mixers, deep freeze and refrigeration equipment, slicers, dishwashers, exhaust fans and the like.

This high school—one of the finest in the country from both an architectural and electrical viewpoint—represents combined planning on the parts of architects Ryder and Link of Schenectady, and electrical consultant Walter S. Stewman of Albany. Electrical work by our company, was supervised by field foreman Frank O'Brien.





**OLD SWITCHBOARD** in Cleveland Works of Westinghouse Lighting Division, while adequate for immediate needs, had no margin for plant load-growth. It was replaced by plant personnel under supervision of plant engineer.



**MODERN NEW SWITCHBOARD** in a relighted, repainted room provides plenty of margin for load growth and new convenience and efficiency. New control desk (center) is located on site of the old switchboard.

# New Switchboard for Old

## *Without Production Interruptions*

Preliminary planning and scheduling of work made possible the installation of new switchboard and changeover from old board with regular maintenance staff in Cleveland Works plant of Westinghouse Lighting Division.

**A**LONG with many other industrial plants, the Cleveland Works of the Westinghouse Lighting Division has seen mounting production activity increase electrical power requirements to new levels. Recently, when it became obvious that further increases would bring power consumption near to capacity of the main distribution switchboard, it was decided to replace the heavily loaded old switchboard with modern equipment.

Although the old switchboard was still adequate within its limitations, new equipment would permit direct benefits in performance and convenience, and the added benefit of freedom from the danger of power interruption, when the load reached the capacity of the old switchboard.

At the same time, circuit breakers on a new switchboard could be selected to give adequate interrupting capacity for new power transformers to be installed by the Cleveland Electric Illuminating Company to supply the increasing plant demand.

Working with engineers from Westinghouse headquarters and the company's Switchgear Division, the Cleveland management decided to replace the old switchboard with modern metal clad switchgear. Another step toward modern distribution facilities was the decision to replace the two obsolete rotary converters with

**By J. S. Scott, Plant Engineer**  
Lighting Division  
Westinghouse Electric Corporation  
Cleveland, Ohio

motor-generator sets for more stable operation.

The new equipment to be installed comprised 18 metal clad units to control all 2300-volt, 3-phase, 60-cycle distribution circuits and four metal-enclosed low-voltage units to control the 250/500-volt direct current distribution.

The 2300-volt metal clad equipment selected used magnetic-type air circuit breakers rated at 50,000 kva interrupting capacity at 2300 volts and 5 kv insulation class.

Totally enclosed in a dead-front structure to handle the increased rating of the new power transformers, the entire 2300-volt structure, including the 18 distribution feeders, synchronous motor field control, and bus metering equipment, occupies floor space measuring 30 ft, 10 in. in length and 5 ft, 4 in. in depth. Overall height is 7 ft, 6 in.

The final selection of modern electrical equipment solved only one phase of the total problem. It remained to work out procedures which would permit the installation and changeover of circuits to the new equipment without interruption to normal production.

To meet this condition would have been impossible if the new equipment were installed at the old location, since several weeks would have been required to dismantle and remove the existing switchgear, install the new, and install and connect the necessary control and power circuits. The only time available for installation was during the annual vacation period when the entire plant is closed for a two-week period.

A solution to this problem of time and space came when it proved practical to mount the new switchgear directly over the old, on a steel balcony that could be erected well in advance of the vacation period. This was feasible because of the compactness of the metal clad switchgear selected.

As soon as this new steel balcony was erected, the metal clad switchgear was assembled and installation begun for the control desk and control cables. Shortly afterward, relay control and circuit breaker operations were tested. During the two-week vacation period, after much preliminary work, there was ample time for all work which remained. This comprised no more than removal of the old switchboard and two rotary converters, installation of two new motor generator sets, and final changeover of power connections.



## How Addition of

# CENTRALIZED LOW-VOLTAGE

By Alfred M. Hall,

Electrical Engineer  
Continental Electrical Construction Company, Chicago, Ill.

**M**ORE than 200 fan motors in the vast air conditioning and ventilating system at Chicago's Merchandise Mart can be started and stopped from a central point in a matter of minutes. Recent addition of a low-voltage remote control system provides this finger-tip control of units ranging

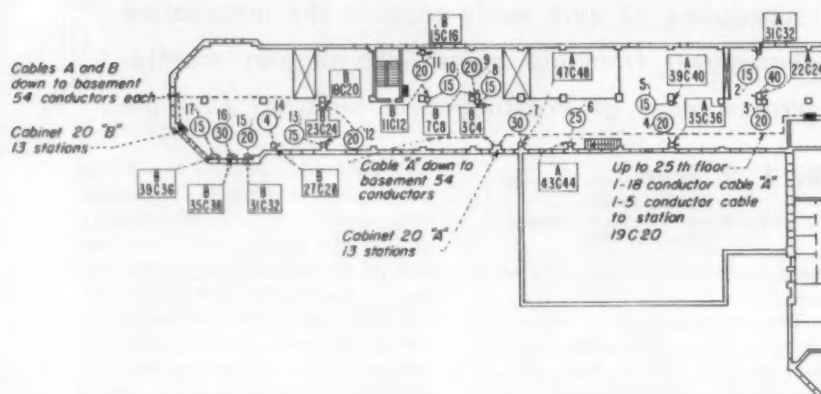
from 3 hp to 75 hp scattered throughout the 25 floors of the large office building. The installation represents one of the largest applications of this type of control to a commercial electrical system.

Two economic factors led to the remote control installation: first, a

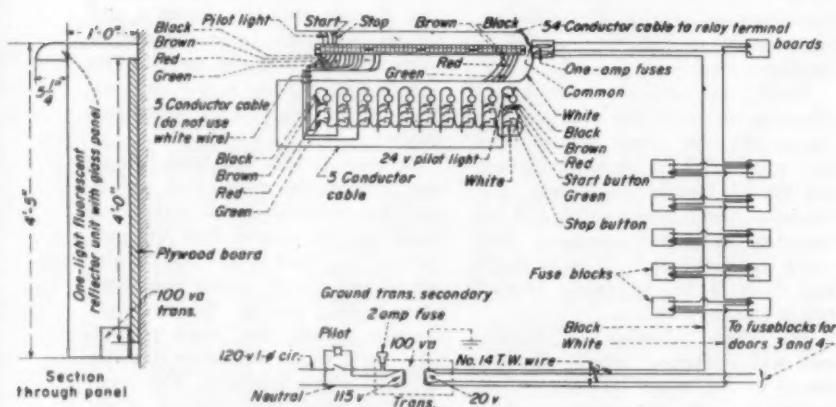
more efficient use of maintenance personnel time; second, the possibility of reducing monthly electric power bills. Control units for the 203 fan motors are at the fan locations. About half of them were without magnetic starters. So, under the old operating procedure two mechanics spent 2½ hours each morning going from floor to floor starting the motors. Again at night, two mechanics spent an equal amount of time returning to shut off the units. This meant that a number of motors were operating from two to three hours more per day than actually required by tenants. Over a period of time this represented a considerable waste of kilowatt hours, particularly when 30-, 40- and 50-hp motors were involved.

### The Solution

Both problems were solved by the addition of a low-voltage relay, centralized remote control system with a master panel in a basement air conditioning equipment room near the chief engineer's office. Now, one man travels the short distance from the office to the panel and starts the fan motors in accordance with a predetermined schedule based on tenant requirements. The only precaution necessary is that a sufficient time-delay be given between starts to permit motors to come up to speed. This prevents a heavy surge of starting current on the 480-volt, 3-phase delta power system serving the motors. At the end of the day, one man returns to the master panel and shuts down all units in a matter of minutes. Time spent on starting and stopping the motors has been reduced from about ten manhours to approximately one manhour per day. As a result, more efficient use is made of mechanics' time on other assignments. Since motors now can be shut down immediately after tenants leave the offices, substantial savings have been showing up on the power



**FIG. 1—FLOOR PLAN** of small section of 20th floor showing scattered location of fan motors and controls in fan equipment area. Some 203 such motors throughout the 25-floor Merchandise Mart are now operated from a central control board in the basement.



**FIG. 2—TYPICAL DIAGRAM** of wiring and connections to pushbutton stations in central control board. One fuse block and 40-terminal connection block serves 10 pushbuttons and pilot lights of the low-voltage control system. Board has 240 push-button stations.



# MOTOR CONTROL . . . . cut operating cost of vast ventilating and air circulating system at Chicago's Merchandise Mart. Control system involves low-voltage relays and multi-conductor cables.

bills. A power saving is also accomplished in the refrigeration compressor room. With fan operation reduced, the period of centrifugal machine operation can be reduced proportionately. In winter, smaller quantities of intake air will be used with a resultant saving in steam required.

## Why Select the L-V System

When management decided to remedy the existing situation, they consulted with Continental Electrical Construction Company, a Chicago electrical construction and engineering firm that had done considerable work in the Mart over the past decade or more. Centralized remote control was the obvious answer and several systems were carefully considered and analyzed. Among them was an electronic system. However, initial installation cost and the anticipated need of an electronic specialist for maintenance combined to rule this out. What management wanted was a simple, trouble-free system that could be easily maintained by present electrical personnel.

After a complete system survey and analysis of the specific problem, Continental's engineering department submitted a low-voltage relay control package which met the "specifications." Management bought it and Continental installed it. Among the salient features of the system are the following:

1. Simple Design—The components are items familiar to maintenance electricians: low-voltage transformers, relays, pushbutton stations, multi-conductor cables.

2. Positive Pilot Light Indication—Pilot lights above the pushbuttons glow red when the motors are running. Pilot light circuits are fed directly from the motor terminals.

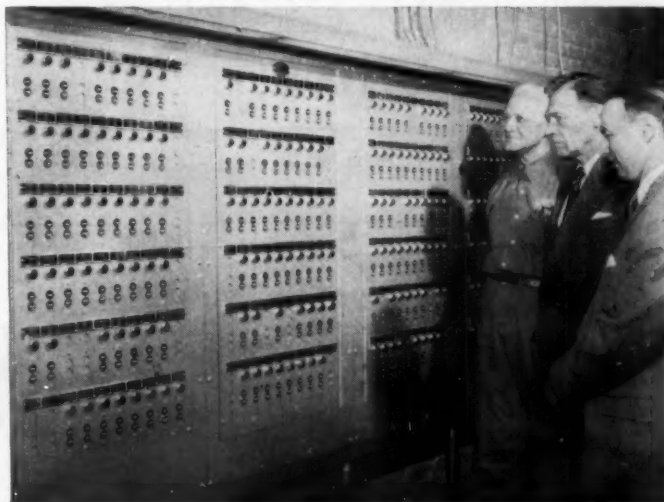
3. Low Maintenance Cost—Relays, with an expected life of more than one million operations, open and close only

when the momentary-contact stop and start buttons are pushed. High-reactance, 24-volt control transformers with their inherent current-limiting characteristics (without the use of fuses) provide an additional safety factor. Replacement frequency of these items, plus pilot lamps, is expected to be exceptionally low.

4. Installation Ease—With the 24-volt system, multi-conductor, telephone-type cables can be used for control circuits. Cable installation can be made in places where space limitations preclude the use of conduit and wire. Careful selection of high-reactance transformers and relay coils (transformer impedance about ten times coil resistance) minimized voltage drop problems. The additional resistance of long conductor runs has a negligible effect on voltage drop. Some of the fan motors are more than 1,500 ft from the central control panel.

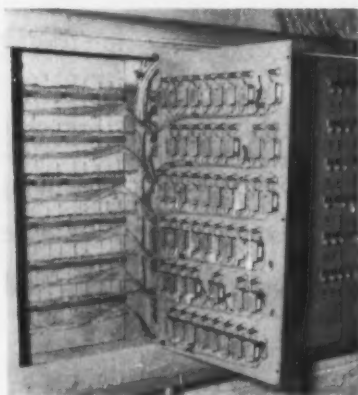
The basic control circuit is simple in design and operation. A standard momentary-contact start-stop button with single pilot light at the master panel operates two low-voltage sensitive relays in a 4-unit relay panel at the motor location. These relays, in turn, actuate two 480-volt power relays mounted in the same panel. The power relays are connected in series and parallel with the stop and start buttons, respectively, in the conventional motor controller. Thus, operating the control button at the master panel is the same as operating the button at the motor location. Multiply this circuit by 203 motors and you have a picture of the complete remote control system.

The *Master Control Panel* in the basement has four piano-hinged, swing-out doors. Mounted on each door are 60 momentary-contact, start-stop pushbuttons, each with a tele-

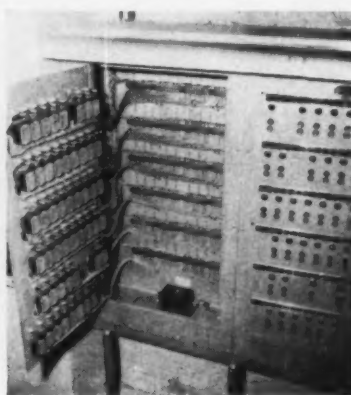


**CENTRAL CONTROL PANEL** in basement has 240 pushbuttons and pilot lights to operate all fan motors. Here, unit gets final inspection by (L to R) Fred Gauss, building engineer, Merchandise Mart; W. A. Stahl, Mart operating manager; and A. M. Hall, Continental Electrical Construction Co., electrical engineer who designed the low-voltage control system.

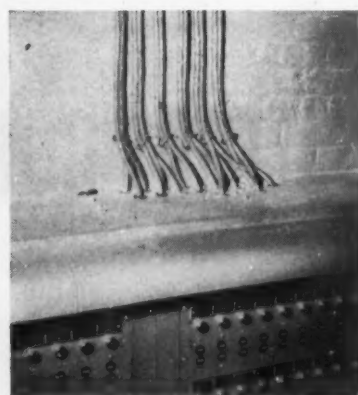




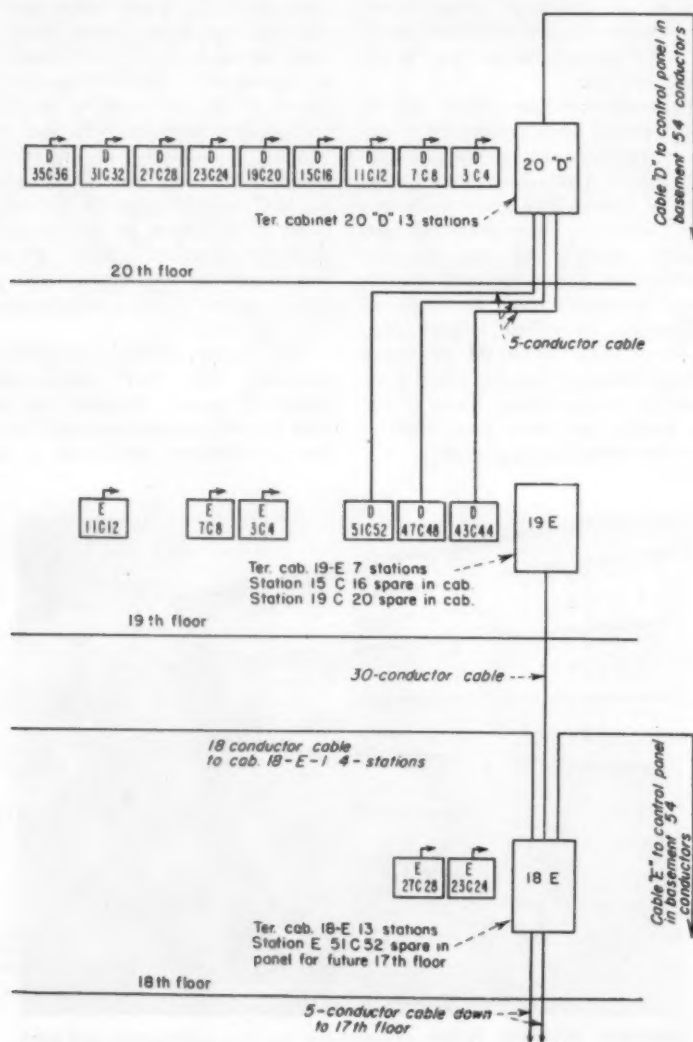
**SWING-OUT DOORS** on panel provide access to low-voltage terminal strips and back connections to pushbuttons and pilot lights in basement central control panel. Each of four doors has space for 60 control stations.



**POWER SOURCE** for remote control operation of some 480 low-voltage sensitive relays at motor locations is this 100-v-a, 115/20-volt transformer in panel trough. Primary is controlled by lock-switch with pilot light and is fused at 2 amps.



**CONTROL CABLES** with a total of more than 900 conductors leave the top of the central control panel and go to terminal cabinets on various floors. Note use of telephone-cable loops to support multi-conductor thermoplastic sheath cables.



**FIG. 3—PARTIAL RISER** diagram showing use of floor terminal cabinets between 54-conductor home run cables and individual motor control stations. Numbers in squares identify control station and connections.

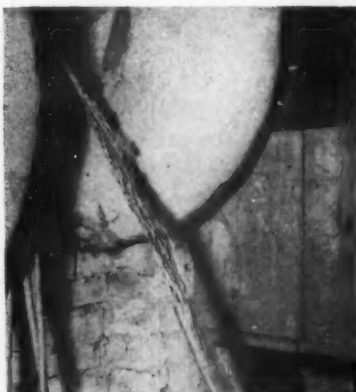
phone-type, slide-base, 24-volt pilot light and identification nameplate. Of the 240 pushbuttons on the entire panel, 37 are spares at the present time.

Terminal strips and 1-amp fuse blocks are mounted on a plywood board at the back of the cabinet. There is one strip and one fuse block for each ten pushbuttons (Fig. 2). Each pushbutton station requires five conductors: two for the pilot light circuit; three for the control station—start, common and stop. Each terminal and station has a stenciled code identifying the motor controlled.

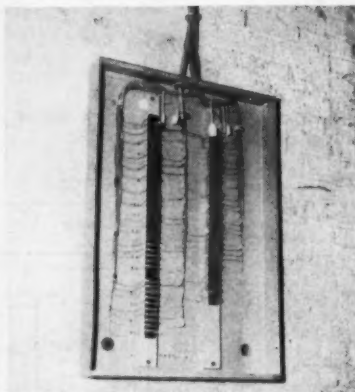
A single 100-v-a, 115/20-volt transformer provides power for all buttons in the panel operating all sensitive relays in the system. The transformer primary is protected by a 2-amp fuse and controlled by a lock-type switch with pilot light located on the extreme right side of the panel. The secondary is grounded and goes to the fuse blocks serving the terminal strips. A switch-controlled, continuous fluorescent panel illuminates the face of the control board.

**Low-Voltage Circuit Wiring** between system components consists of No. 22 thermoplastic-insulated wires in multi-conductor assemblies with an overall thermoplastic sheath. Cables range in size from 5- to 54- conductor with the larger cables originating at the main control center and ending at terminal cabinets on various floors (Fig. 3, 4). One terminal cabinet serves a maximum of 13 control stations and has a 54-conductor home-

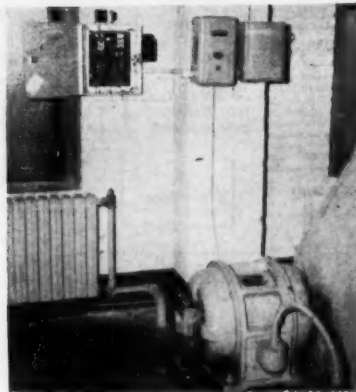




**TYPICAL SPLICE** in 54-conductor low-voltage cable is made with press-on type insulated sleeve connectors staggered to prevent bunching. Clear plastic sleeve (at bottom) is pulled up over splice and taped in place to protect against moisture.



**TERMINAL CABINETS** on equipment floors are junction points for 54-conductor home run cables and 5-conductor cables to fan motor controls. Color coding and numbered terminals combine to simplify connections.



**MOTOR CONTROL** center at fan locations consists of standard disconnect switch, magnetic starter and new low-voltage relay panel at left. Relays are operated by pushbutton in basement control panel.

run cable. Where there are more than 13 motors on a floor, additional terminal cabinets are used with the size of the home-run cable depending upon the number of stations per cabinet. Because of the scattered location of motors on each floor, single 5-conductor cables go from terminal cabinets to individual motor control stations.

All low-voltage cables are the color-coded, twisted-pair type with no pair in any one cable having the same two colors. Wires to the top and bottom terminals of the pilot lights are black and brown respectively. Red is the color for the "start" button; green for the "stop" button; and white for the common conductor.

The *Relay Panel* installed at each motor control location is the heart of the low-voltage control system. At this point, the electrical impulse from the main control panel is transferred to the 480-volt starter which operates the fan motor. To make the system complete, magnetic starters had to be added to the control equipment for about half of the motors.

Each panel controls a single motor and contains four relays and two control transformers. The two sensitive-type relays at the bottom of the panel (Fig. 5) have 3-amp, 115-volt, normally open contacts and 20-volt, 60-cycle coils which respond to operation of the pushbuttons at the centralized control panel in the basement. Power for these relays is provided by the 100-volt transformer in the basement control board.

The sensitive relays, in turn, operate

two power relays at the top of the relay cabinet. The power relays have 24-volt, 60-cycle coils with 480-volt, 15-amp, double-break contacts (double-break to attain the 15-amp rating). Current to operate these relays is obtained from a 45-volt, 480/24-volt, high reactance transformer whose primary is connected to the line side of the motor controller.

One of the power relays has a normally closed contact and is connected in series with the stop button in the motor controller. The other relay has a normally open contact and is connected in parallel across the start button in the controller. When these relays operate, the motor starts and stops just as it would if the pushbuttons in the adjacent motor controller were operated.

The second high reactance control transformer on the relay panel is a 15-volt, 480/24-volt unit with its primary connected to the load side of

the motor controller. The secondary goes direct to the 24-volt pilot light above the pushbutton station in the central control board in the basement. No control transformer fusing on the load side is necessary when high-reactance units are used.

#### Circuit Identification

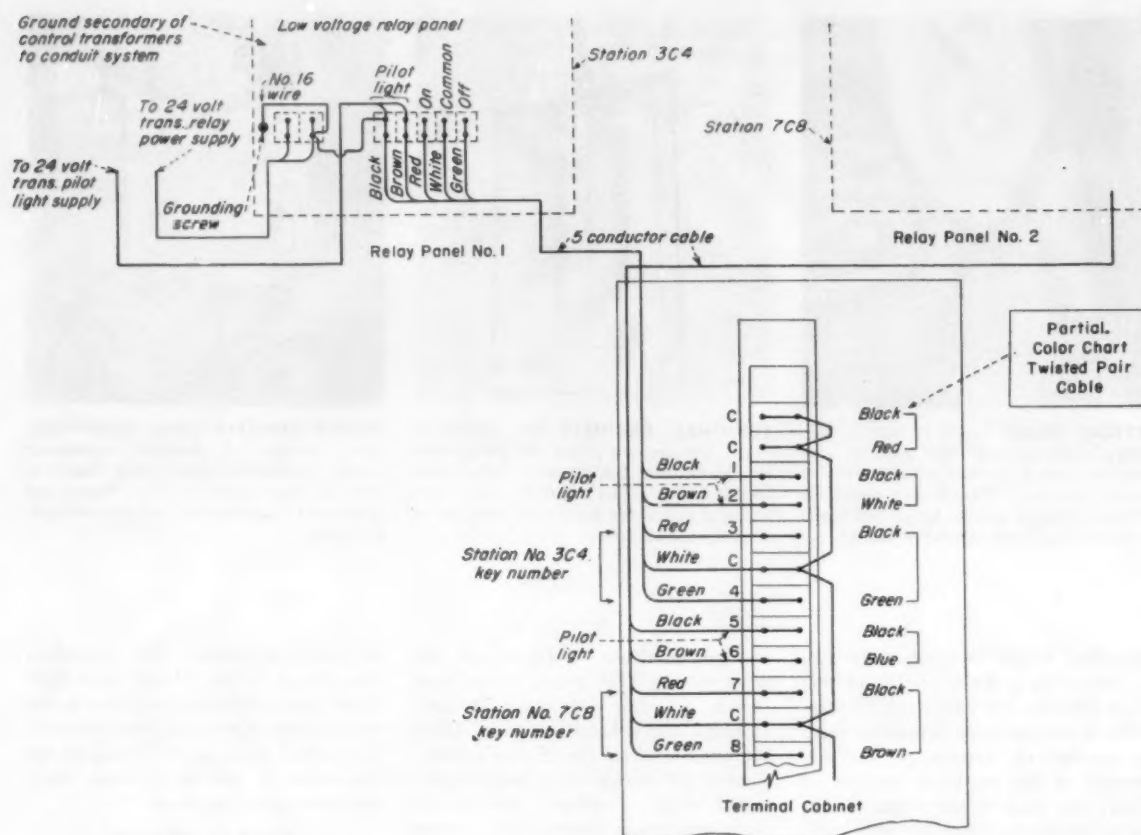
Each individual control circuit carries a coded identification from the relay panel terminals down to the pushbuttons in the main control board. To illustrate the method used at the Mart, consider two motor stations with coding as shown below.

Basis for the circuit coding is the use of the number before and after the common conductor "C" for each of the 13 stations served by the 54-conductor home run cable (one terminal cabinet). Thus, the code identification of the 13th station on cable "A" would be 51-C-52 "A". The system is repeated on cables "B", "C",

	Relay Terminal Marking	Wire Color	Connected To	Terminal Cabinet Marking	Main Panel Marking	Pushbutton Marking
	1	Black	Pilot Light	1		
	2	Brown	Pilot Light	2		
Station Code No. 3-C-4	3	Red	Start Button	3	3-C-4 A	3-C-4 A
	C	White	Common	C		
	C	White	Common	C		
	4	Green	Stop Button	4		
	5	Black	Pilot Light	5		
	6	Brown	Pilot Light	6		
Station Code No. 7-C-8	7	Red	Start Button	7	7-C-8 A	7-C-8 A
	C	White	Common	C		
	8	Green	Stop Button	8		

"A" is the identification of the home run cable.





**FIG. 4—TERMINAL CABINET** wiring diagram showing typical connections between terminal strips and low-voltage relay panels at motor locations. Standard color coding is black and brown wires for pilot light; red for stop button; green for start button; white for common conductor.

"D", and the rest of the 18 home run cables entering the central control board. With this method, all cables of a specific control circuit can be identified easily at the central board, the floor terminal cabinet and the relay panel at the motor location.

#### Installation and Testing

Biggest installation advantage of the low-voltage control system was the ease with which the multi-conductor cables could be trained around beams and other building obstructions; also, the fact that they could be run in places where space limitations precluded the installation of any type of raceway. In general, telephone cable loops were used to suspend the control cables from the ceiling and mount them to the building walls. The loops are supported by shields set into the concrete on 16- to 18-in. centers. A slow-speed electric drill with carbide-tipped bits worked well on the masonry encountered. One-hole cable straps were used on the single runs of 5-conductor cable to motor relay panels.

The control cable was available

only in 500-ft lengths. Since many of the floor terminal cabinets were up to 1,000 and 1,500 ft away from the basement, one or more splices were required in the 54-conductor home runs to the central control board. At such splices, press-on type insulated sleeve connectors were used on the individual conductors with connections staggered to prevent bunching. A transparent plastic sleeve, slid over one end of the cable before the splice was made, was then pulled up over the entire length of the multi-conductor splice and secured at both ends with plastic tape. This provides water-tight protection which can be opened, when necessary, by merely removing the tape and sliding the sleeve back over the cable.

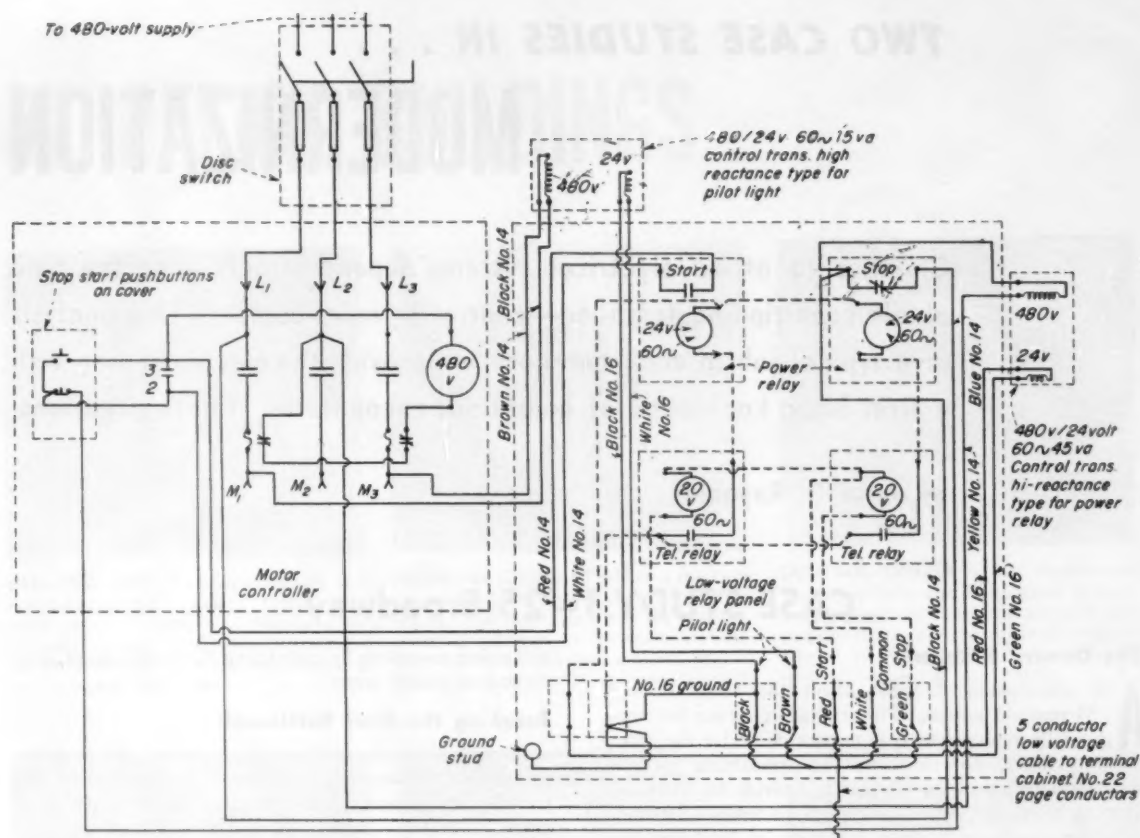
Press-on type lugs were used on the control conductors at all terminal points in the main control panel, terminal cabinets and individual relay panels. Application of this technique cut connection time considerably. The combination of color coding and circuit identification made circuit installation and connection relatively simple. Detailed shop drawings of the com-

plete system with circuit diagrams at all connection points left no room for doubt or confusion. The installation went in without a hitch.

Since all conductors in the home run cables are color-coded twisted-pairs, splices were made visually by connecting like color pairs. When all connections were completed, the cable was tested by two mechanics with sound powered telephones: one at the central control board and one at the floor terminal cabinet. With telephones connected to both ends of one twisted pair, say black and red, communication was established between the two men. The electrician at the terminal cabinet then "jumped" the next twisted pair and told his associate at the central control board the colors of the conductors. The latter then measured the resistance of this closed loop. The process was repeated until all twisted pairs were checked. If all splices and corrections were correct, the ohmmeter indicated the same reading for every pair of wires in the cable.

Relay operation was checked in a similar manner. Sound powered tele-





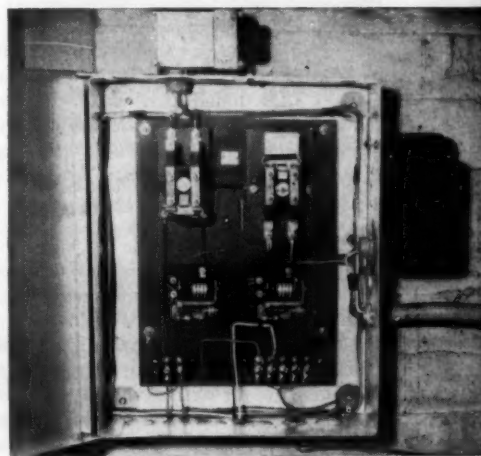
**FIG 5—LOW VOLTAGE RELAY** connections to standard motor controller at fan locations. Telephone-type relays (bottom) operate power relays (with low-voltage coils) at top which are connected in series and parallel with controller stop and start buttons respectively. High-reactance, 480/24-volt control transformers provide current for power relays and pilot light.

phones provided communication between mechanics at the relay panel and the central control board. Telephone leads at the relays were clamped to the "on" terminal (red wire) and "off" terminal (green wire) of, for example, control station 7-C-8 on cable "A". The man in the basement connected his telephone to the corresponding terminals 7-C-8 "A" in the main board. The number before the "C" is the "on" conductor; the one after, the "off" conductor. Since the control circuit is open unless the pushbutton is operated, these conductors can be used for telephone communication. Relays were adjusted and remote control operation checked in this manner. Telephones were disconnected from the circuit before relays were operated.

A similar method of checking is being considered for maintenance purposes. For example, in case of trouble on any particular cable pair, telephones could be connected to both ends of a circuit pair in the same cable not in operation at the time, and testing procedures at both ends could be closely coordinated.

**RELAY PANEL** added to each motor control center has two sensitive relays (bottom) which operate two power relays (top) connected in series and parallel with the stop and start buttons in motor controller. High-reactance 480/24-volt transformer at right provides current to power relays. Similar unit at top serves pilot light circuit.

**SOUND POWERED** telephone is used during circuit and relay testing by Continental superintendent John Mix to talk to associate at central control panel in basement. L-V control circuit can be used for communication when pushbuttons are not operated.





# MODERNIZATION

Changes to office electrical systems depend largely upon the type of air conditioning installed—central or room coolers. This analysis of a typical job in each category will provide the electrical man with a firm basic knowledge of conditions encountered in both situations.

By John P. Reynolds

## CASE STUDY 1—25 Broadway

### The Owners' Problem

**A**IR conditioning brought about the crisis in this 34-year old building. The original dc service had been partially replaced in 1945 to provide ac for the upper floors of the 22-story building. The remaining portions were changed over to ac in 1948 to provide for increased lighting levels desired by several large tenants and also to accommodate an increasing number of local air conditioners which tenants were putting in. A marginal dc service was maintained to supply elevators and other existing power equipment. At the completion of the 1948 changeover, the building had an ac distribution system capable of delivering  $3\frac{1}{2}$  watts per sq ft, all that was deemed necessary at the time.

The full solution had not been obtained, however. Tenants such as Anaconda, Bethlehem Steel, and the Cunard Line found that window units did not afford sufficient cooling to serve the large interior areas of their offices. A coordinated cooling system appeared necessary if the competition of the many new 100% air-conditioned office buildings was to be met.

### The Engineer's Answer

A central air conditioning system was the first suggestion offered by Kerby Saunders, Inc., the mechanical contractors for the Cunard Building job. This would consist of cooling towers on the roof; water refrigeration condensers in the basement; large central fans on each floor to blow air across chilled-water coils; and a duct network on each floor for air circulation.

Anaconda Wire & Cable Co., Anaconda Copper Mining Co., and Bethlehem Steel Co., the three tenants occupying the upper floors of the building, preferred a cooling system that would afford a greater degree of individual control for the many executive offices in their respective areas. Kerby Saunders met this requirement by employing 1083 fractional hp fan-coil units mounted under the windows on the eleven top floors with central  $7\frac{1}{2}$ -hp units to circulate fresh air and provide auxiliary cooling. Booster pumps and electrical distribution for all these units are centered on the eleventh floor.

During cold weather, the entire system is converted

to heating operation by circulating hot water to all units instead of chilled water.

### Breaking the Riser Bottleneck

As with all commercial rewiring projects, the principal installation problem revolved around the location of new electrical risers and, in this case, air conditioning water pipes.

It is seldom possible to bring raceways up through rented space since the noise of cutting concrete floors is intolerable to tenants, even if they will accept the inconvenience of having workmen in their offices during business hours. The noise factor also restricts use of hallways for this purpose, especially in marble-faced corridors of older buildings where sound reverberates endlessly.

A favorable solution was arrived at when the building's managers found that careful scheduling of elevators would permit them to remove one lift from service.

Three sub-distribution panels on the 4th, 9th and 11th floors were located near to the abandoned shaft to minimize horizontal runs of the several  $3\frac{1}{2}$ -in. conduits, each of which contained four 500MCM type RH conductors. A multiple feeder consisting of six No. 4/0 RH cables in two  $2\frac{1}{2}$ -in. conduits was also run in the shaftway to supply cooling tower fans and pumps on the roof. In addition, an air conditioning control center was installed in the sub-basement to supply the numerous heavy pumps and auxiliary motors located there and to house the central controls of the entire system.

### New Service Equipment

To avoid extensive changes to the existing ac service and the main distribution panels, all of the air conditioning power load was put on a new and independent 6000-amp service. A copper bus tie from the utility company's stubs was run to a main switchboard by Lord Electric's mechanics. The main board consisted of a 3-phase, 4-pole main disconnect and breakers to protect feeders to the control center in the equipment room and the other sub-distribution panels on the fourth, ninth and eleventh floors. In addition, four ventilating fans of the old ventilating system serving the first four floors



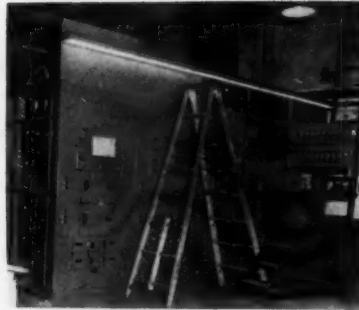
# OF OFFICE BUILDINGS



**FAN-COIL UNITS** replace radiators and window type room coolers. New equipment consists mainly of a fractional hp fan which passes air across coils containing either hot or chilled water depending on the season of the year.



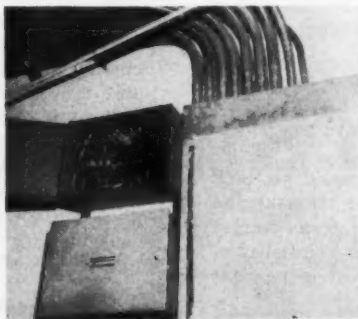
**FRESH AIR CIRCULATION** and auxiliary conditioning is provided from central units which distribute air through ceiling-mounted diffusers in the main corridor. Fluorescent troffers give a sleek, modern appearance to the 34-year-old building.



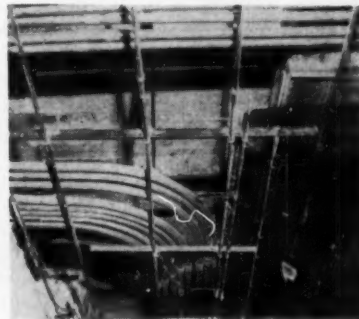
**CONTROL CENTER** in air conditioning equipment room distributes power to basement pumps and fans; also contains control devices (right) for automatic regulation of the entire system. Indicating signals tell location of any trouble.



**TWIN RISER CABLES** of 500 MCM RH-RW are tapped with single 750 MCM conductors at the fourth floor panel location. Cable in right background is 30-conductor control wiring pre-assembled for the contractor by Anaconda.



**UHF PULSE SIGNALS** from control center actuate motor starters and magnetic contactors on panels controlling 1083 small fan-coil units. Test signals are transmitted every 20 minutes to check for inoperative equipment.



**CIRCUIT CONDUITS** for fractional hp fan-coil units on upper floors radiate from sub-distribution on the eleventh floor. All horizontals are run in the hung ceiling on this level and supported by reinforced framework of the ceiling.

were swung over to the new main board. Although disconnects and starters for these four motors were located at the main switchboard, the controls were tied to the control center in the equipment room.

This relieved the existing ac service of a load amounting to 65 hp plus that of the several hundred window air conditioners that were eliminated.

## Provisions for New Circuits

As most of the new air conditioning equipment was situated in the basement or central fan rooms on the first 11 floors, the installation of circuit wiring was limited to provision for the 1083 fan-coil units mounted under the windows on the 11 upper stories. Power circuits for the 7½-hp auxiliary cooling units on each of the upper floors are run from the eleventh floor sub-distribution panel through the abandoned elevator shaft.

Conduits were run from the four 42-circuit panels on the 11th floor in the hung ceiling which was being installed to conceal ductwork radiating from this floor's central conditioning unit. Conductors were run vertically in common conduits alongside of water pipes on columns next to windows where the fan-coil units were located. Conduits were concealed along with the water pipes behind boxed-out lath and plaster.

## Special Construction Features

The entire air conditioning system is manually or automatically regulated from the control center located in the basement equipment room. The "brain" of the automatic control is an IBM program equipment which provides master regulation of all fans and blowers in the entire air conditioning system. Fans are also controlled locally by thermostats, pressurestats, etc., but they may



only be operated while the master control has closed the circuit. In effect, this feature limits operation to regular office hours.

The programming unit transmits UHF pulses to 24 receivers located at various distribution and control points in the building. These receivers activate relays which open or close the pilot circuits of fan motor starters and the magnetic contactors on the main buses of the four panels supplying the 1083 fan-coil units on the upper floors. Receivers are arranged on four separate channels or frequencies. Activating signals for the four channels are sent out at intervals of 20 seconds in order to limit the affects of high starting currents impressed on the distribution network. Upon operation of its equipment, each receiver returns an "acknowledge" signal to the con-

trol center. Lack of acknowledgement indicates trouble on the power equipment.

Separate conduits were installed for the numerous control wires involved in this control system so that more than nine conductors could be pulled into them. Several of these control circuit conduits were required to accommodate 30 or more No. 12 wires. Even with a conduit of ample cross-sectional area, pulling so many conductors might have been a difficult job; Lord Electric solved this problem by having the Anaconda Wire & Cable Co. make up a "cable" consisting of 30 TW wires twisted and bound together at 1-ft intervals. This was delivered by Anaconda on a reel so that all Lord's men had to do was pull in the tightly bound cable along with any additional conductors that were called for in the plans.

## CASE STUDY 2-11 Broadway

### The Owners' Problem

A combination of circumstances brought about the action of the Broadway Realty Co., owner-manager of the Bowling Green Offices at 11 Broadway. The building operated on dc obtained from 3 steam- and 5 diesel-powered generators with a total capacity of 2025 kw. This equipment was giving unsatisfactory service because of high maintenance and operating costs. In addition, the capacity of the entire electrical system—power plant, switchboards, feeders, panels—had been stretched to its limit.

This condition, together with the desire of the owners to provide better lighting and facilities for air conditioning tenants' offices, dictated an extensive modernization of the building's electrical system.

Because many of the smaller tenants would probably be unwilling to accept the rent increase necessary to amortize a central air conditioning system, it was decided that provision for cooling would be limited to installation of adequate power capacity in the distribution network to operate any local air conditioning units that the individual tenants might want. Costs of operation and wiring from floor panels to the units would then be added to the user's rent.

Essentially, the problem was to design a new electrical system that would be flexible enough to meet changing

and unequal demands at each distribution point, one that could be installed without interfering with tenant electrical service.

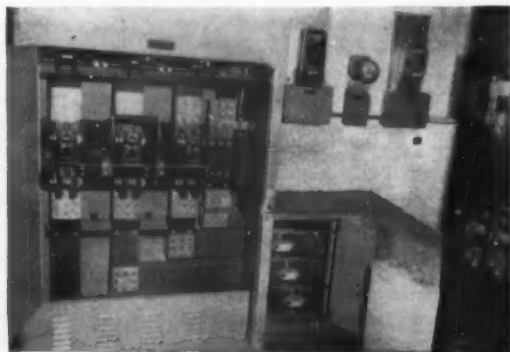
### The Engineer's Answer

After studying the existing equipment, project engineer P. A. O'Riordan, who handled the job for consulting engineer E. E. Ashley, made up a schedule for 100% changeover to a utility-supplied ac distribution that would provide ample capacity for anticipated loads. Three local panels on each typical floor would be supplied with sufficient feeder capacity and space for additional circuits as future tenant demands required them. Tenants would be charged a flat rate for any added service.

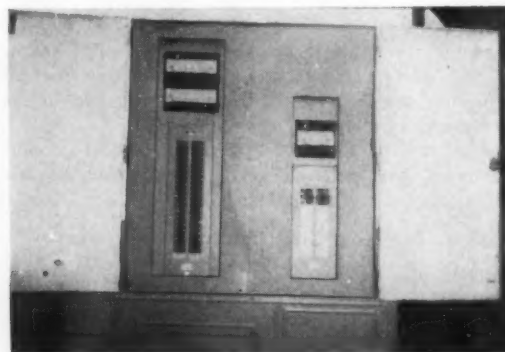
Because this project involved a complete revision of existing electrical services, O'Riordan set up a step-by-step program for accomplishing this without interfering with tenant operations during office hours. Feeders were installed during the week and connected to circuits at night or on weekends.

### Breaking the Riser Bottleneck

As with its neighbor, new riser conduits were a critical part of the modernization operation in the Bowling Green Office. The existing dc risers were located alongside the elevators in the main wing of the E-shaped building; at

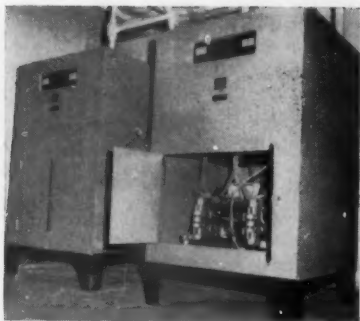


**PRESSURE TYPE SWITCH** rated at 5000 amps is one of two main service disconnects. Twin services were needed because of the lack of under-sidewalk vault space in the crowded downtown district.

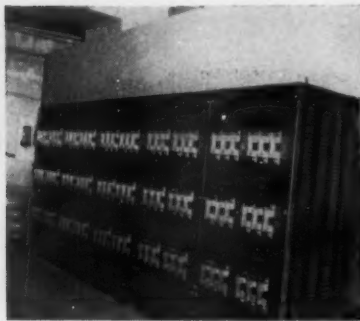


**NEW AC PANELS** on the individual floors were mounted in old dc panel and meter cabinets. Lighting circuits are supplied from 42 circuit breaker assembly at left while panel at right affords space for 24 air conditioning circuits.





**DIRECT CURRENT EQUIPMENT** is supplied by three rectifier units. Rated at 50 kw dc, these assemblies will each deliver up to 75 kw with forced fan cooling. Second and third rectifiers are brought into the line automatically as load increases.



**MAIN SWITCHBOARD** consisting of 30 3-phase 400-amp knife switches is supplied from both services. Fuses are mounted on the rear of the free-standing unit. Board was installed in five separate sections to permit gradual shifting of load.



**MODERNIZED LOBBY** features square coffers with continuous strips of deluxe warm white lamps concealed in the perimeter molding. The suspended ceiling provided a convenient freeway from installation of lateral runs of new conduits.

each floor they branched over to a central panel across the hall from the elevators and from there to panel and meter cabinets at either end of the main corridor. O'Riordan had the Lorson Electric Co., contractors for the project, install new vertical conduits at each of these three locations: six running through rest rooms at the east panel site; two through the center shaft with the three existing conduits; and seven at the west end of the corridor. The east and west riser points were selected because they were on the reverse side of the partitions on which the panels were located and, secondly, because these spots permitted concealed installation without too much annoying noise.

The horizontal components of the new raceways were situated in a new hung ceiling then being installed in the main floor lobby. This avoided the expense of hanging conduits on the already overcrowded basement ceiling.

### New Service Equipment

Dual services were brought in from the utility's under-sidewalk transformer vaults, each having a capacity of 3500 amps at the regular Con Edison voltage of 115/208 volts, 3-phase. Each service is protected by a 5000-amp enclosed pressure switch fused at the bus capacity. The switches feed a free-standing switchboard made up of five sections with six 400-amp 3-pole knife switches to a section. Provision is made for two additional sections when needed. Fuses are located on the rear of the main board.

As one of the original diesel power plants occupied space where the main board was to be located, it was necessary to install a single section of the new board and change over the load served by this generator; then when the set had been taken out, the remaining sections of the board were set in place. This process was repeated later to provide room for new dc rectifiers and controls which were installed to serve elevators and other undepreciated dc power equipment in the building.

### Provisions for New Circuits

Changes in the circuit wiring did not constitute an important part of the modernization of the Bowling Green Offices since the project involved only the conversion of existing tenant service to ac and provision of added capacity at local panels. Any tenant requiring additional facilities pays extra rent covering the installation and operation costs.

Hanging ceilings along the main and west corridors will permit circuits to be fished to any office bordering on them, while surface metal molding will be employed to bring in new circuits from locations in the east wing.

In most instances, however, it is anticipated that rewiring of existing branch raceways with thinwall-insulated wire to the 50% conduit occupancy permitted by the National Electrical Code will meet the majority of tenant requests for added circuit capacity.

### Special Construction Features

Considerations of economy dictated that usable existing dc power equipment such as the 17 elevators and various pumps and certain special motors throughout the building should be kept on dc rather than being replaced by new ac motors.

To supply this continually changing dc load, engineer O'Riordan selected a system of three 50-kw selenium rectifiers with combined convection and fan cooling. Under conditions of heavy demand, the forced-draft cooling permits steady operation at loads up to 75 kw per unit. These Walker units have an efficiency of 88% to 90% plus or minus 2% and voltage regulation of 8% to 10%.

The main dc switchboard houses three current-sensitive relays of different settings which switch the first, second, and third rectifier units into or out of the main dc circuit as load fluctuates.

The feedback of regenerative voltages caused by descending elevators is regulated by relays which automatically cut in protective resistors across the dc mains.

Before the conversion, branch circuit protection and tenant meters were located in large, 10-in. deep, flush cabinets at the ends of the main corridor. Special panelboards were constructed to bring the surface of the panels to the front of the recessed space; the ample remaining room in the back of the cabinet will make future rearrangement of circuits and feeder connections a simple matter.

All feeders run through common pull boxes immediately behind these panels so that the loads on individual risers may be easily changed to balance load conditions.

These two studies represent the most common types of office modernization work encountered today: Case 1, the installation of an independent electrical system to serve air conditioning; Case 2, increasing the capacity of the existing distribution to meet overall growth in demand.





## NEW YORK TO WELCOME NECA

**The 54th annual convention of the National Electrical Contractors Association will feature association objectives, opportunities in electrical modernization and an electrical products show.**

**"MODERNIZE Electrically"** is the theme of the 54th anniversary convention of the National Electrical Contractors Association and the First National Electrical Exposition, which will be held at the Waldorf-Astoria Hotel in New York City, October 31 through November 3.

The first formal business session will open Monday morning, October 31. This session will feature an address by Don B. Clayton, Sr., Birmingham, Ala., president of NECA, on electrical modernization. Progress on NECA objectives and a report from the Board of Governors will be presented by Paul M. Geary, executive vice president. The subject of atomic energy and the electrical contracting industry will be a feature of this meeting.

The program for the second session on November 1 consists of the following talks: "This is Our Job" by Jack Doscher, director, Operation Home Improvement; "The Key to Growth" by William C. Lehmann, manager of sales training, General Electric Company; "NECA Business Development Program—Selling Modernization and Selling Line Construction" by P. Howard Farley, sales promotion manager, NECA; "The Little

Man—Can He Keep Afloat in a Sea of Bigness" by the Honorable Emanuel Celler, chairman of the Judiciary Committee of the House of Representatives; "NECA Governmental Affairs Program" by George B. Roscoe, director of public relations, NECA.

On Tuesday afternoon there will be a discussion on Area Diffused Lighting with Robert A. D. Schwartz as the discussion leader.

The third general membership session on November 2 will include talks on "Profits in Construction" by Donald E. Denton, vice president and manager, Insurance Department, American Trust Co., Charlotte, N. C.; "Job Management for Profits" by Charles P. Bobe, chairman, NECA Research Committee; "Electrical Contractors and Code Developments" by W. H. Biester, chairman, NECA Codes and Standards Committee. In the afternoon there will be a forum discussion on Codes and Standards with W. H. Biester as the chairman.

On Thursday, November 3, the final day of the convention, there will be at 7:00 a.m. an open meeting of the Line Construction Committee. Paul Geary will report on the progress of NECA's efforts to promote the interest of line construction con-

tractors and "Bill" Damon, director, National Joint Apprenticeship and Training Committee will discuss the status of apprenticeship training program for linemen.

The fourth session of the convention will include addresses by the following: "The IBEW and the Electrical Contractor" by Gordon M. Freeman, International President, International Brotherhood of Electrical Workers; "Labor Relations in the Public Interest" by W. J. Cour, director, Labor Relations, NECA; "Progress and Problems in Apprenticeship" by "Bill" Damon, director, NJATC; "Making the Pension Program Actuarially Sound" by Joseph D. Keenan, International Secretary, IBEW. Also the newly-elected officers will be introduced.

The formal opening of the First National Electrical Exposition will be on Monday evening in the Jade and Basildon Rooms, Astor Gallery, Waldorf-Astoria. The Exposition will feature the displays of the latest in electrical materials, equipment and tools manufacturers offer the electrical construction industry. There will be 62 exhibitors. The final session of the Exposition will be on Wednesday.

The Committee has arranged a very interesting social calendar for the members and guests. On Sunday, October 30, there will be a reception from 4:00 p.m. to 6:00 p.m. given by the New York City Chapter, and at 8:00 p.m. a theatre party at Radio City Music Hall has been planned. On Monday afternoon there will be a sightseeing trip around Manhattan island and a trip up the Hudson River on the "Peter Stuyvesant". On Wednesday afternoon there will be a visit to an ocean liner and warship.

The ladies' luncheon is planned for Tuesday afternoon on the Starlight Roof, Waldorf-Astoria. Also of interest to the ladies will be the three specially arranged breakfasts to be given at B. Altman & Co., one of New York's finest stores. The breakfasts will be followed by entertainment including a style show.

The annual banquet will be held Thursday evening in the Grand Ballroom of the Waldorf-Astoria.

John Doris is chairman of the committee responsible for the program of the convention and the members are A. Lincoln Bush, Harry F. Fischbach, Louis Freund, John W. Frommer, Samuel W. Hurowitz, Efrem A. Kahn, William Leibfried, Sidney P. Lipkins, Loren C. MacNutt, Henry C. Parke, George F. Price, Harold A. Webster, and Chester Williams.



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# DATA SHEET

## Amperes in Alternating Current Circuits

### SINGLE-PHASE CIRCUITS

Amperes for One Kilowatt at Different Power Factors

Volts	POWER FACTOR IN PER CENT						
	100	95	90	85	80	75	70
100	10.0000	10.5263	11.1111	11.7647	12.5000	13.3333	14.2850
110	9.0909	9.5693	10.1010	10.6652	11.3636	12.1211	12.9870
115	8.6957	9.1533	9.6619	10.2302	10.8696	11.5942	12.4224
120	8.3333	8.7719	9.2592	9.8040	10.4166	11.1111	11.9049
125	8.0000	8.4211	8.8889	9.4118	10.0000	10.6667	11.4286
210	4.7619	5.0125	5.2910	5.6022	5.9524	6.3492	6.8027
220	4.5455	4.7847	5.0505	5.3476	5.6819	6.0606	6.4936
230	4.3479	4.5766	4.8309	5.1151	5.4349	5.7971	6.2113
440	2.2727	2.3923	2.5252	2.6738	2.8409	3.0303	3.2467
550	1.8182	1.9139	2.0202	2.1390	2.2728	2.4242	2.5974
1100	0.9091	0.9569	1.0101	0.0695	1.1364	1.2121	1.2987
2200	0.4545	0.4785	0.5050	0.5348	0.5682	0.6061	0.6494
2300	0.4348	0.4577	0.4831	0.5115	0.5435	0.5797	0.6211
2400	0.4167	0.4386	0.4630	0.4902	0.5208	0.5556	0.5952
2500	0.4000	0.4210	0.4444	0.4706	0.5000	0.5333	0.5714
6600	0.1515	0.1595	0.1684	0.1783	0.1894	0.2020	0.2165
11000	0.0909	0.0957	0.1010	0.1070	0.1136	0.1212	0.1299
13000	0.0769	0.0810	0.0855	0.0905	0.0962	0.1026	0.1099
25000	0.0400	0.0421	0.0444	0.0471	0.0500	0.0533	0.0571
45000	0.0222	0.0234	0.0247	0.0261	0.0278	0.0296	0.0317
60000	0.0167	0.0175	0.0185	0.0196	0.0208	0.0222	0.0238

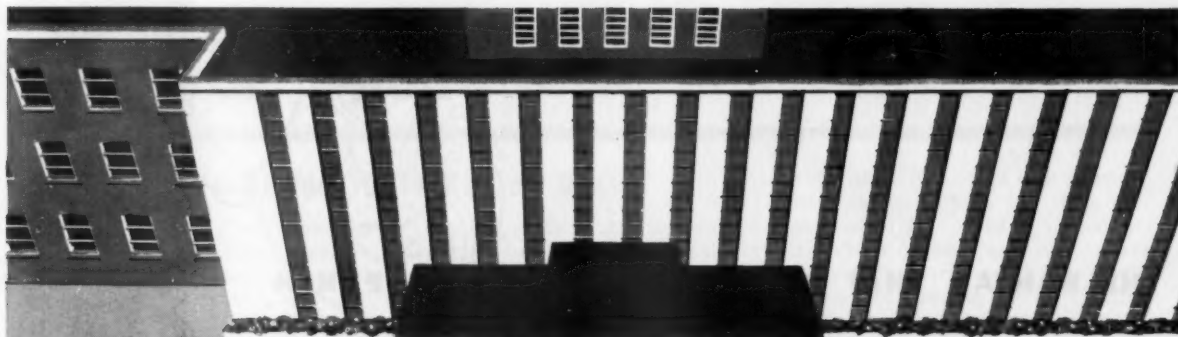
### THREE-PHASE CIRCUITS

Amperes per Wire for One Kilowatt at Different Power Factors

Volts	POWER FACTOR IN PER CENT						
	100	95	90	85	80	75	70
100	5.7735	6.0774	6.4150	6.7924	7.2169	7.6980	8.2479
110	5.2486	5.5249	5.8319	6.1749	6.5608	6.9982	7.4980
115	5.0204	5.2847	5.5783	5.9064	6.2756	6.6939	7.1721
120	4.8112	5.0645	5.3458	5.6603	6.0141	6.4150	6.8732
125	4.6188	4.8619	5.1320	5.4339	5.7735	6.1584	6.5983
210	2.7493	2.8940	3.0548	3.2345	3.4366	3.6657	3.9276
220	2.6243	2.7624	2.9159	3.0874	3.2804	3.4992	3.7490
225	2.5660	2.7010	2.8511	3.0188	3.2075	3.4213	3.6657
230	2.5102	2.6423	2.7891	2.9532	3.1378	3.3470	3.5860
240	2.4056	2.5322	2.6729	2.8301	3.0070	3.2075	3.4366
400	1.4434	1.5194	1.6038	1.6981	1.8042	1.9245	2.0620
440	1.3122	1.3812	1.4579	1.5437	1.6402	1.7495	1.8745
500	1.1547	1.2155	1.2830	1.3585	1.4434	1.5396	1.6496
550	1.0497	1.1050	1.1664	1.2350	1.3121	1.3996	1.4996
1100	.5249	.5525	.5832	.6175	.6561	.6998	.7498
2100	.2749	.2894	.3055	.3234	.3437	.3666	.3928
2200	.2624	.2762	.2916	.3087	.3280	.3499	.3749
2300	.2510	.2642	.2789	.2953	.3138	.3347	.3586
2400	.2406	.2532	.2673	.2830	.3007	.3208	.3437
2500	.2309	.2431	.2566	.2717	.2887	.3079	.3299
6600	.0875	.0921	.0972	.1029	.1093	.1167	.1249
11000	.0525	.0552	.0583	.0617	.0656	.0700	.0750
20000	.0289	.0304	.0321	.0340	.0361	.0385	.0412
25000	.0231	.0243	.0257	.0272	.0289	.0308	.0330
33000	.0175	.0184	.0194	.0206	.0219	.0233	.0258
50000	.0115	.0122	.0128	.0136	.0144	.0154	.0165
55000	.0105	.0111	.0117	.0124	.0131	.0140	.0150
60000	.0096	.0101	.0107	.0113	.0120	.0128	.0137

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The project engineer for the Howard P. Foley Company noted that the SPANGLEAM EMT, bundled in blue plastic tape, was particularly easy to handle. This bundling proved to be a safety factor, since sections of the conduit did not slip out as sometimes happens with conduit bundled by rope.

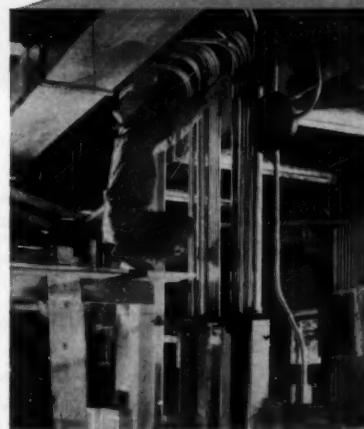
Roy Stoy, electrical sub-foreman on the job, said, "The bending quality of

SPANGLEAM EMT proved to be most satisfactory, and there was no cracking, chipping or peeling of the finish."

About SPANG HD galvanized conduit Mr. Stoy remarked, "SPANG HD has easier threading and reaming qualities. There were no burrs or other inside obstructions."

That's SPANG *quality control* at work for West Penn Power! It's a result of careful control during manufacture, finishing and inspection at SPANG's Etna Plant. It produces *top-quality* SPANG Conduit, ideal for every type electrical installation.

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Both SPANGLEAM EMT and SPANG HD Galvanized Conduit connect with this control panel at West Penn Power Company's headquarters building. Power will be supplied by two 208/110-volt transformers and one 480-volt transformer.

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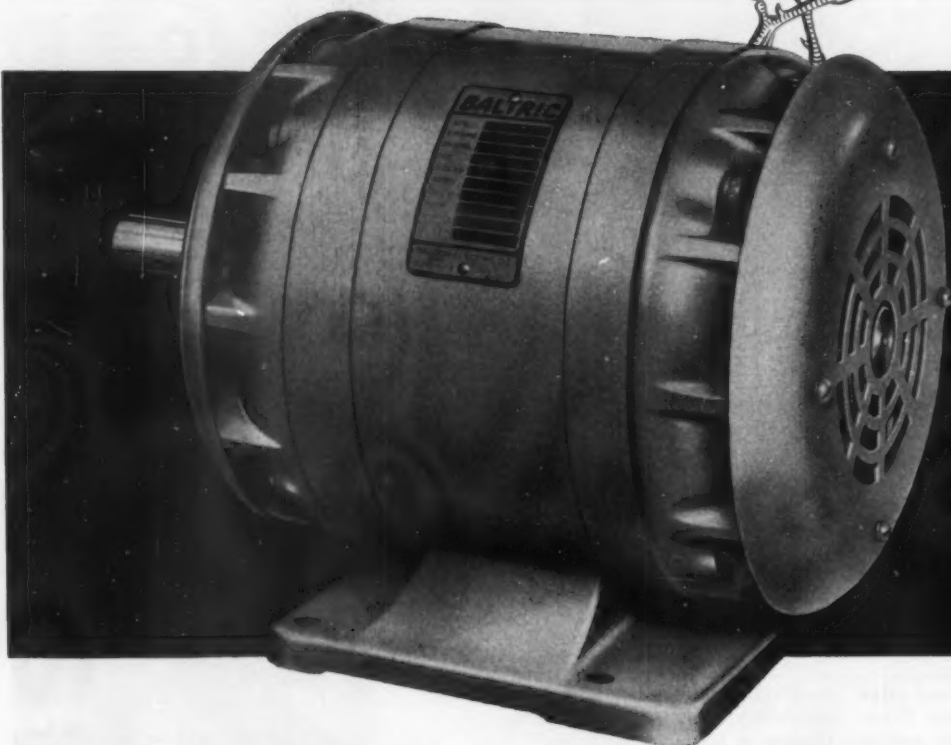
- Owner:  
West Penn Power Company, Greensburg, Penna.
- Architect:  
Hoffman & Crumpton, Pittsburgh
- General Contractor:  
O. H. Martin Associates, Pittsburgh
- Electrical Contractor:  
Howard P. Foley Company, Pittsburgh
- Spang Distributor:  
M. B. Squires Company, Pittsburgh



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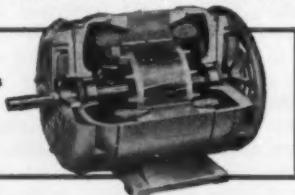
The new *Streamcooled Baltrac* line of completely enclosed motors are champions, every one, all sinew and muscle . . . compact, powerful, efficient. Advanced engineering using the newest materials, enables Baltrac to offer you hard-working power packages.

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# Motor Shops

## Oven Divider Cuts Baking Cost

Efficiency of baking operations has been stepped up by employing removable partitions in the main oven of the motor service shop of the L & P Electric Construction Co. in Brooklyn, N. Y.

Overall interior dimensions of the oven measure about 7 ft long by 3 ft wide by 3½ ft high. This entire space can be used for baking components of large motors. For smaller integral-hp motors, however, the oven is divided into two or three independent sections by partitions of ½-in. asbestos fiber. Slots for holding the dividing partition are made of 1- by 1- by ½-in. angle irons bolted to the sides of the oven and spaced about ¼-in. apart to permit the board to slide freely down between them. As there is one pair of slots at the mid-point and one at the quarter-point, it is possible to use a quarter, a half, or three-quarters of the oven space at one time.

The resistance type electric strip units which heat the oven are arranged to permit use of any of the above sections independently. Each compartment is served by a separate set of heaters having their own contactors, switches and thermostats.

Heating elements are mounted on brackets along the lower walls of the oven. To avoid excessive smoke caused by varnish dripping on the heaters, there is a sheet metal covering over the top and the exposed side of the heater banks. Circulation is accomplished by the air being drawn in around the ends of the covering, then passing over the heating elements and out through the perforations in the vertical face of the cover. Exhaust pipes of 3-in. conduit are included in each compartment to inhibit leakage of hot air into the equipment room where the oven is located.

The heavily insulated cover of the oven is hinged and is folded back up against the wall by only a slight lift, as its weight is balanced by a pulley and counterweight arrangement.

Motor components to be baked are hung in the oven on 36-in. lengths of pipe which are rested on horizontal angle iron members set at varying levels around the walls of the oven.

Controls for the oven are located in the main workroom adjacent to the door to the equipment room where the oven is. The compact shop-made control panel consists of: rotary switches

which allow the heat in each compartment of the oven to be set at low, medium, or high; pilot lights indicating which compartments are in use; and a timer which regulates the length of the baking period. The three single-pole contactors for each set of heating units are all remotely located in the shop's main switchboard where all such equipment is placed for simplified maintenance.

In addition to this large oven, L & P employs a small unit of similar design for baking out fractional-hp motors. This oven is mounted on the wall adjacent to the main oven and is controlled from the same panel.

Service manager Fred Young of L & P explains the merits of the compartmented oven this way, "By adjusting the size of the oven to suit the baking job, we keep power costs down; and by using the compartments separately we can have as many as three jobs baking at one time."

## Oil Lubrication Of Ball Bearings

Design engineers generally provide for the lubrication of machinery by means of grease. There are many instances, however, where grease would be unsuitable. Therefore they provide for lubrication by means of oil. Examples where oil would be more applicable would include (1) high speeds, where the churning of grease would create too high an operating temperature, (2) very low temperatures, where grease would be too stiff and would offer too much resistance to the turning of the shaft, (3) high operating temperatures, where grease would be subject to separation, drying out, decomposition and oxidation, and (4) large size units, where lubrication reliability is essential, and where it is necessary to wash out the unit without stopping or dismantling it. This could not be done with a grease lubricant.

Oil is an ideal lubricant for bearings, but the tendency of oil to leak out of its housing is the reason why most machines are designed for lubrication by grease. Grease is easy to seal, and it actually helps exclude dirt.

In favor of oil, however, it should be pointed out that (1) oil is more stable, (2) it is adaptable to both subnormal and abnormal temperature



**REMOVABLE COMPARTMENTS** in baking oven permit size of heated space to be adjusted to fit the job. Asbestos fiber boards are slipped into slots formed by pairs of angle irons. Electric strip heaters in each section are on separate circuits, controlled by individual thermostats. Each set of heaters may be regulated to deliver any of three temperatures.





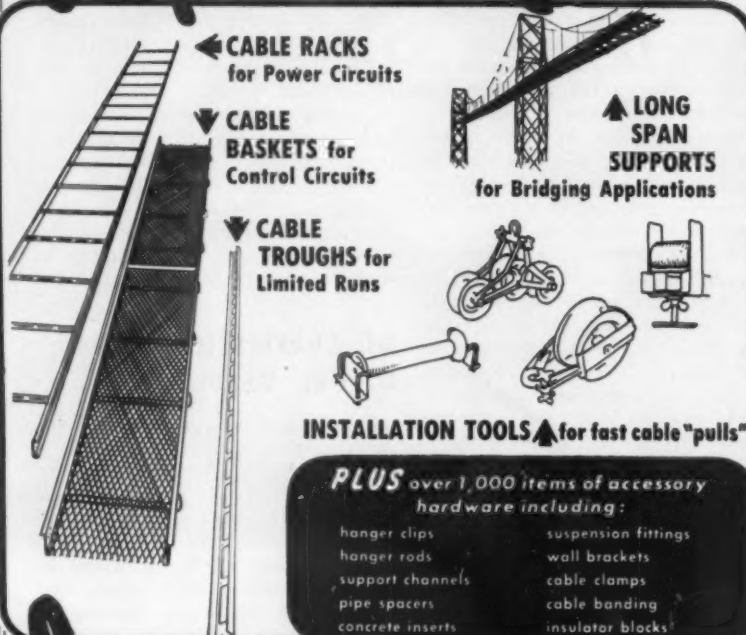
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conditions, and (3) good oils are easily obtained.

So, in dealing with oil, keep in mind that (1) oil is difficult to seal, therefore inspections for leaks should be made frequently, and (2) oil requires frequent replenishment at normal temperatures, and frequent replenishment at high temperatures.

Depending upon speed, temperature and various other operating conditions, oil lubricating arrangements for bearings differ. For speeds below 500 rpm, oil levels are relatively unimportant but, for higher speeds, the lubricating system generally provides for an oil level at the center of the lowest ball or roller in the bearing. This level is generally checked and maintained by means of a sight gauge, overflow, tell-tale level gauge or other method.

Where no means are provided for maintaining the oil level, care should be taken not to add too much oil, as this would probably produce a rise in temperature due to churning. In general, bearings suffer more from over-lubrication rather than from under-lubrication. Excesses or deficiencies of oil may be effected by bent feed pipes, so inspection should also include the checking of this possible cause for improper oiling.

At high speeds around 3000-rpm or above, an oil mist is all that is really necessary to lubricate a bearing, so lubrication can be obtained via wick, oil or circulating feeds.

Since oil is subject to gradual deterioration from use, contamination from dirt and moisture, or accumulated sludge, drainage and flushing at regular intervals are necessary in many applications.

Initial flushing should be done with a light (spindle) oil, but the second flushing should be with the same oil as that used to lubricate the bearing. Where the unit is extremely dirty or the oil is extremely heavy, it is also recommended that the housing be flushed with clean hot (around 120 degrees F) kerosene, a good grade of carbon tetrachloride, or an approved safety solvent. After using these special flushing liquids, however, the final flushing should be with the light, then regular oil.

To avoid adding dirt, grit, dust or other harmful foreign matters, care should be exercised when adding oil. Therefore oil cups should be wiped clean before filling, and under no circumstance should oil be reused.

Seals or "closures" for preventing escape of oil should necessarily be more effective and efficient than when grease is the lubricant. Recommendations for replacing seals should be followed closely.



# WAKEFIELD GEOMETRICS

Another  
Installation



## Modern Savings and Loan Building Beautifully Lighted by Wakefield Beta Units

Here is an interesting pattern of Wakefield Beta units which illustrates the variety of design possibilities open to the architect and contractor who specifies Wakefield Geometrics. In this smart modern interior three different Beta sizes were used—1'x4', 2'x4' and 4'x4'—to give a maintained level of 55 footcandles. (There is still another size: 2'x2'.)

Beta is a recessed unit with a Rigid-Arch Plexiglas diffuser. The diffuser, which distributes the light evenly, with little or no direct or reflected glare, has a matte surface which will not mirror lights from the window when the lamps are turned off.

(The Wakefield Omega is a companion unit for on-surface mounting, in the same four sizes.)

Write for a catalog on the Beta and the Omega.

THE WAKEFIELD COMPANY  
VERMILION, OHIO  
WAKEFIELD LIGHTING LIMITED  
LONDON, ONTARIO

Dearborn Federal Savings  
and Loan Building, Dear-  
born, Michigan

Job Engineerd by William  
Sanders, Electrical Engi-  
neer, Bennett and Straight,  
Architects and Engineers,  
Detroit

Electrical Contractor: Paas  
Electric Company, Detroit,  
Michigan





# How Con Edison protects wiring from weather and

*Sealtite in Con Edison's new Astoria, N. Y., plant withstands 150°F on boilers . . . takes up expansion on coal conveyor . . . speeds installation in tight quarters . . . protects wires from salt spray, steam, and dirt all around the plant.*



**1** Three- and four-inch Sealtite is used by Con Edison to take up expansion of conduits carrying heavy power cables on outdoor coal conveyor. At bottom of conveyor, not shown, is Con Edison's famous "floating dock." Here, Sealtite must absorb vibration when coal is being hauled up, resist weather, salt spray from river, coal dust and general grime from industrial area.

Sealtite® is the original flexible, liquid-tight conduit — made with tough, extruded polyvinyl jacket. Industry after industry is discovering how useful Sealtite can be. Con Edison has used it for years in its stations. No wonder their engineers put it to work in their newest, most modern plant. Here Sealtite is used: to protect wiring outdoors and in . . . in wet spots, dust spots, corrosive spots; where wiring must flex or be moved; to absorb vibration; to meet misaligned outlets; and to speed installation in cramped spaces.

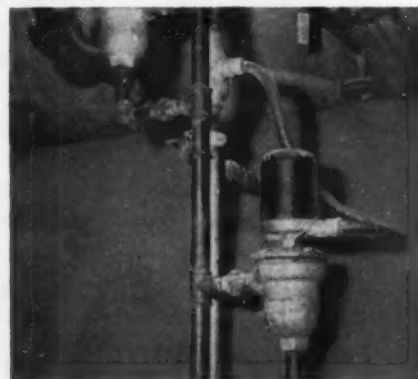
**TYPE U. A.** is approved by Underwriters' Laboratories for service in wet spots. Copper conductor wound spirally inside conduit for positive ground.

**TYPE E. F.†** is extra flexible. Ideal for machine tool applications. Meets J.I.C. standards. Available in machine tool light gray at no extra cost from mill stocks.

Electrical Wholesalers stock both types in easy-to-handle coils. Buy it in long lengths; cut it on the job without waste. They also stock special liquid-tight connectors manufactured by Appleton; Thomas & Betts; Gedney; and Pyle-National.

For more information, write The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. 65167

†Trade mark  
1°Fol. Applied for



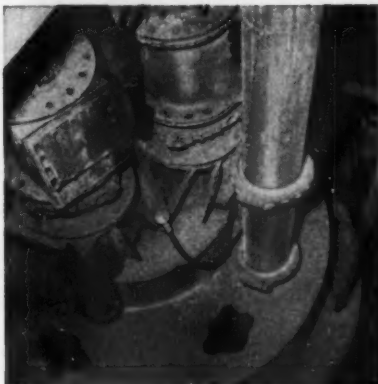
**2** Steam leakage forms white crud on ¾" Sealtite leading to aerators on high pressure heaters. Despite high heat and corrosive conditions, Con Edison expects Sealtite to last the life of the equipment.



# corrosion with Sealtite flexible, liquid-tight conduit



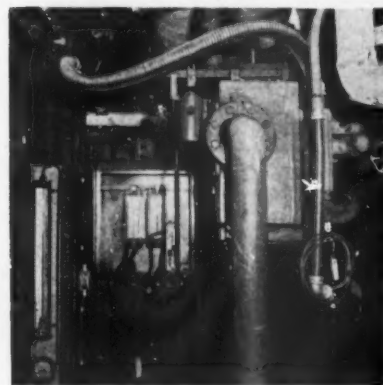
**3. Movement**—caused by rising and falling temperatures—is taken up by Sealtite leading from automatic combustion stokers to hot air dampers.



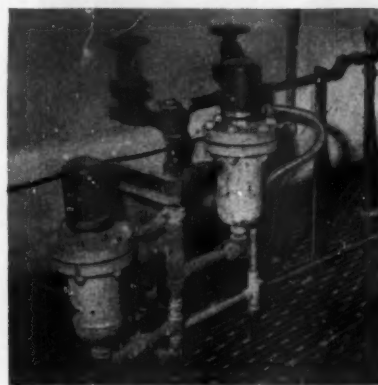
**4. Too hot to handle!** This is the top of one of the boilers at Con Edison's Astoria plant. A real hot spot—but Sealtite takes it day after day.



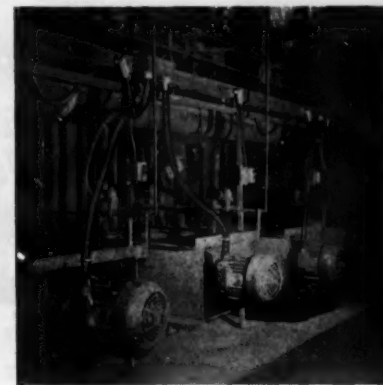
**5. Sealtite speeded installation**...saved time, trouble and money in tight quarters; e.g.: Solenoid valves controlling water spray for ash in bottom of boilers.



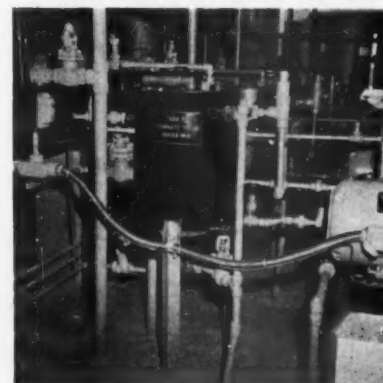
**6. High pressure steam valves** connected with Sealtite—where steam leakage and high heat are most severe. Sealtite resists moisture and grime throughout plant.



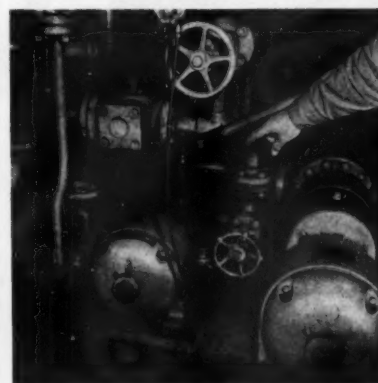
**7. 120°F—and no shade.** Sealtite is connected to high pressure heaters—where water is heated before return to boilers. Sealtite simplifies replacement of parts.



**8. Six-inch rise and fall** of boiler takes place as it heats and cools. 1½-inch and ¾-inch Sealtite takes up this movement, resists heat, moisture and dust.



**9. In chemical room,** Sealtite connects phosphate pump. Here, phosphate and zeolite are mixed with water used in the steam generators. Tough vinyl jacket on Sealtite gives wires lasting protection.



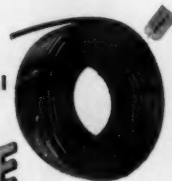
**10. Oily grit packs** Sealtite on this motor connection. Still no trouble. This flexible, liquid-tight conduit takes up vibration, simplifies installation, protects wire and cable all around the plant.

Insist on the original

**SEALTITE**

FLEXIBLE, LIQUID-TIGHT CONDUIT

an **ANACONDA**® product





# a Profitable compliment



**ROTO-GLO®**  
quiet switches

**BECAUSE SWITCHES SHOULD BE SEEN  
... NOT HEARD!**

Where you have a choice of switches to install in a home, it's a compliment to your customers to install the most modern switch. And with ROTO-GLO the compliment is also a profitable one. It offers you lower installation costs and quality construction, eliminating expensive call backs.



**Despard Type**  
15 Amp.,  
120 Volts AC  
or  
277 Volts AC



**Strap Type**  
15 Amp., 120  
Volts AC

Modern screwless terminals mean fast, snug-fit connections without changing basic wiring habits. Totally enclosed plastic body and non-oxidizing silver alloy contacts assure years of trouble-free performance.

ROTO-GLO switches feature whisper quiet operation and a luminous knob that glows in the dark. They turn off and on like a modern radio or TV switch. And walls stay cleaner around ROTO-GLO switches, too. Even children develop a gentle two-finger switch operating habit instead of making wall smearing passes as they often do at toggle switches.

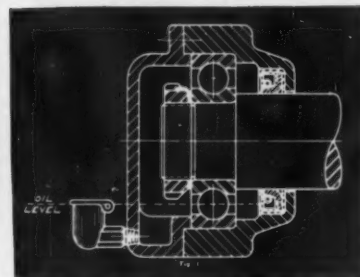
ROTO-GLO Identification tags tell everyone that you've used the finest switches available. Imprint your name on the tag. It's good advertising for good business. For complete details write Dept. RG-23.



**P&S** **PASS & SEYMOUR, INC.**  
Syracuse 9, New York  
23 Murray St., New York 7, N. Y. 1229 W. Washington Blvd., Chicago 7, Ill.

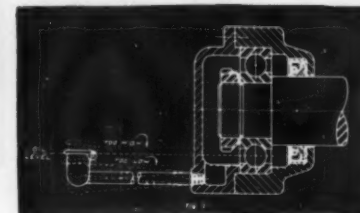
When felt rings are replaced, they should be white all-wool felt—not black, grey or colored. Certain flange type seals are highly recommended for oil retention and may be used to replace less efficient seals in some applications. Also, since a seal for grease lubrication is not as effective as one for oil lubrication, never attempt to lubricate with oil a bearing housing made for grease.

Typical oil lubrication arrangements are illustrated in the accompanying sketches. Fig. 1 shows the



application of a simple oil cup, providing a positive controlled supply of oil. The top of the cup should be located in such a position that the oil level will reach the middle of the lowest ball. This type of cup requires frequent inspection and refilling.

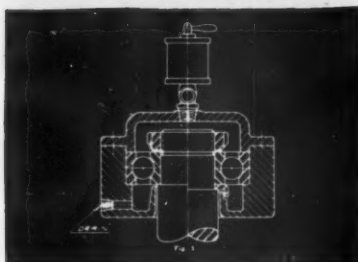
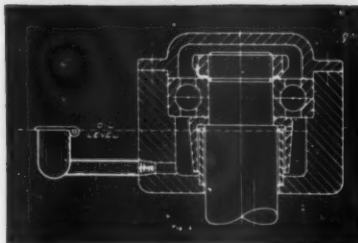
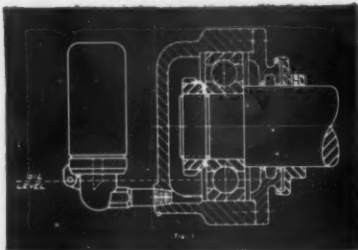
In some cases, oil cups are used which have extra long or odd-shaped pipe connections (Fig. 2). These



should be inspected to see that they are not bent or out of place. If the cup is too high, there is danger of churning the oil and overheating the bearing; also the level may be so high as to cause leakage of the oil out of the housing. If the pipe is bent downwards, the oil level may be so low as not to provide sufficient lubrication for the bearing.

A very satisfactory means of maintaining a positive controlled oil level in the bearing housing and a liberal oil supply which permits less frequent inspection and relubrication is illustrated in Fig. 3. And an example of a vertical application with an oil lubricating system consisting of a reservoir and internal flinger or baffle is shown in Fig. 4, where the position of the oil cup is selected to prevent flow of oil over the top of the stand-pipe. The flinger is of such a shape





that oil is pumped up into the bearing. Designs of this kind always provide for close clearances between stationary and rotating parts. Also note the small hole in the flinger which prevents capillary action and resulting syphoning of oil from trap.

Fig. 5 shows the application of a sight feed oil cup to a vertical mounting, and this type of cup is also used in horizontal mountings. The oil falls by gravity from the cup and through the bearing in a small controlled quantity. The trap and drain below catches the oil and prevents leakage along the shaft beneath the bearing.

If this oil is used again, it should not be allowed to come into contact with any foreign matter which would be injurious to the bearing. In such a case it is advisable to provide a felt wick in the oil cup to filter the oil before it reaches the bearing. As indicated in the sketch, two different types of flingers are applicable. The one at the right is used for comparatively low speeds where there is little danger of leakage, while the one at the left is for higher speeds.

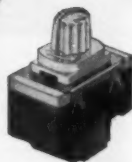
In many applications, the same oil which lubricates the gears or other moving parts also serves to lubricate the ball bearing (Fig. 6). This illustration shows a bearing mounted next to a pinion, the pumping action of the meshing teeth bringing oil to the bearing. Note the flinger or baffle

# for quality wiring jobs

## with a modern touch



### DESPARD LINE



Despard Type  
ROTO-GLO Switch  
15 Amp.  
120 Volts AC  
277 Volts AC



Despard Type  
Flush Pilot  
Light with 1/25th  
Watt Neon Lamp



Despard Type  
Outlet

Combine as many as three separate devices in the space previously required for a single switch. That's the P&S Despard way to modern, quality wiring for new construction or for remodeling.

There are modern ROTO-GLO Quiet Switches that glow in the dark, long-wearing outlets, pilot lights flush or dome shaped or convenient night lights. Make any combination to best fit your individual wiring plans.

Despard devices cut costs, save time and make more attractive, neater installations. Combinations can be assembled right on the job. P&S Despard devices are 100% interchangeable, too. They fit standard switch boxes. In many cases additional pilots or outlets can be added without expensive rewiring.

For complete details  
write Dept. ECM-4.



### PASS & SEYMOUR, INC.

Syracuse 9, New York

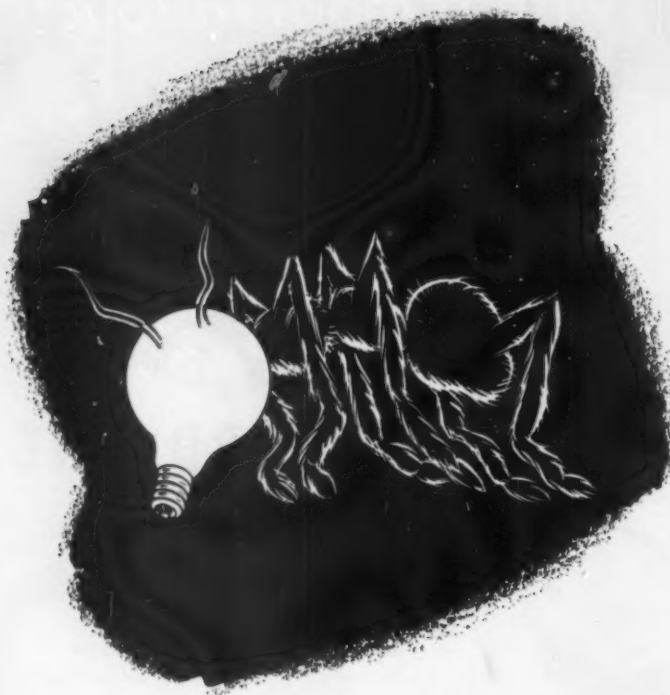
71 Murray St., New York 7, N. Y. 1229 W. Washington Blvd., Chicago 7, Ill.



**GOT**

**RESIST-ANTS**

**IN *Your* PLANTS?**



*Resist-ants* march off with chunks of power where plant lighting efficiency lags. Keep free of these pests by putting into practice the suggestions in the *Champion Maintenance Manual*\* and by keeping an ample supply of efficient CHAMPION Lamps on hand.



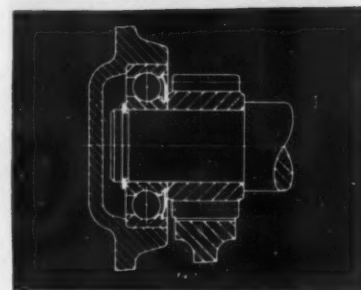
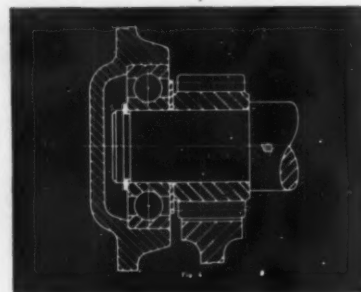
\* *May we mail you a copy?*

*Free to anyone within the borders of the United States.*



**CHAMPION LAMP WORKS**

312 Lynnway, Lynn, Massachusetts



plate, which is used between the bearing and gear to prevent entrance of an excessive amount of oil.

The final sketch (Fig. 7) illustrates similar conditions to those shown in Fig. 6, except that a shielded (instead of open type) of ball bearing is used. A bearing of this type is protected from an excess of lubricant and dirt in the oil by its built-in shield. In normal operation, the positive head or pressure of oil insures a gradual supply of lubricant to the bearing.

Shop men may have occasion to replace the open type of bearing with one of the shielded type to eliminate troubles due to excess lubrication or presence of foreign matter. This is readily accomplished because of exact interchangeability in dimensions.

These suggestions constitute part of a report prepared by the Anti-Friction Bearing Distributors Association.



**EARL S. BROOKS**, manager, United Electric Motors, Seattle, Wash., motor service shop effectively uses an "account aging" sheet to keep tabs on delinquents. Compiled monthly, it gives a quick picture of a customer's defection in payments.



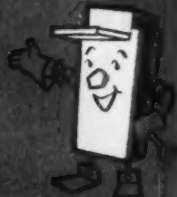
# "The Sky's The Limit"

—when you build with UNISTRUT®



## Mr. Strut shows way to save space, money on conduit racking with UNISTRUT® framing

● This conduit installation was recently done in an industrial plant with UNISTRUT framing. It was a complicated task to arrange the many different lines, but UNISTRUT framing did it fast and kept costs low. This is how it was done—



● UNISTRUT framing reduced installation time because everything needed—channels, clamps, insulators, fittings, concrete inserts—are part of the complete UNISTRUT system. No special fabrication needed.



● Here you see how the concrete insert makes installation easy and fast. It provides a fastening point all along its length. Fittings can be attached quickly and adjustments made while work progresses. Everything bolts together. Much easier than welding!



● Three simple steps ... that's all it takes to assemble UNISTRUT framing. No welding or drilling required. Think of the time, labor and engineering you will save with this quick-erected system.



● And UNISTRUT framing is ideal for all types of conduit racking. Here you see cable trays and wall racking in a power plant. With this system you can make changes or additions at any time. You can even disassemble and use it over and over as supports or frames for almost anything.



## Free Catalog!

Send today for your free copy of the 78-page catalog No. 700. Shows countless examples of how to rack, frame, suspend and support all kinds of mechanical and electrical equipment.

U. S. Patent Numbers  
2341908 2329815 2345650  
2363382 2696139 2380379 2405631  
Other patents pending



UNISTRUT PRODUCTS COMPANY  
1013 W. Washington Blvd.  
Chicago 7, Illinois

Dept. E-10

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☐ Catalog No. 700 ☐ UNISTRUT sample

Name.....

Company.....

Address.....

City..... Zone..... State.....



# Complete "Line-to-Load" MOTOR *Control and Protection*

**ALLIS-CHALMERS**  
**Type H Starters**  
FOR 2300 TO 5000  
VOLT MOTORS

**in ONE  
Compact Unit**

**T**HE Allis-Chalmers Type H high voltage starter is a complete control unit. Everything needed for efficient motor control and positive protection is engineered into one easy-to-install cubicle.

Control functions, varying with specific job applications, include full or reduced-voltage starting, acceleration, speed control, reversing or non-reversing, and dynamic braking.

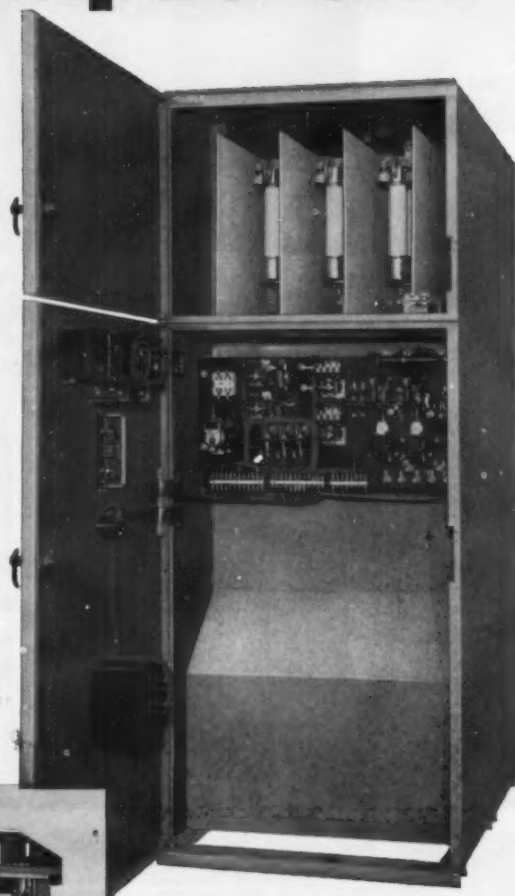
#### **A few of the many protective features**

**Current-Limiting Fuses** clear short circuit in less than  $\frac{1}{2}$  cycle . . . long before short can damage contactor or motor.

**Overload Thermal Relay** adjusts for ambient temperatures . . . trips only on motor overload. Allows use of maximum capacity.

**Time-Delay Undervoltage Relay** permits restarting if power is restored within its setting.

**Compartmented Enclosures** isolate high voltages. Dead front construction and electrical interlock on fuse compartment provide additional personnel protection.



**Choice of  
Air or Oil  
Contactors**

For complete information, see your Allis-Chalmers representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 1486410B.

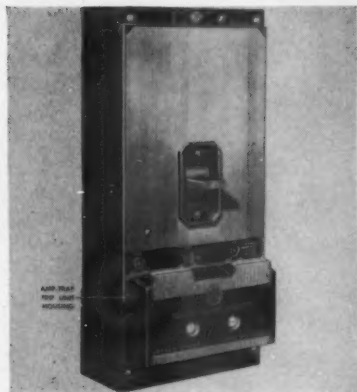
A-4580



## **ALLIS-CHALMERS**



# Product News



**Circuit Breaker**

(1)

A new conception low-voltage circuit breaker design, that provides short circuit current protection up to 100,000 rms amps, has been developed. The Cordon circuit breaker weds a current-limiting device to a standard molded-case circuit breaker—both in a common molded housing. The standard circuit breaker section of the unit contains the conventional thermal trip (for minor overloads) and instantaneous magnetic trip (for all faults below extreme short-circuit currents). Thus the repetitive action of circuit breaker is retained and replacement need be made only after major short circuit faults which exceed the normal interrupting rating of the standard breaker.

The current limiting fuses are designed to assume the fault clearing duty from the thermal and magnetic trips at 80% of the interrupting rating of the breaker section.

The compact fuse element that makes this new breaker feasible is a specially designed current-limiting device, called Amp-trap. The Amp-trap design is such that short-circuit current is completely interrupted in a quarter cycle.

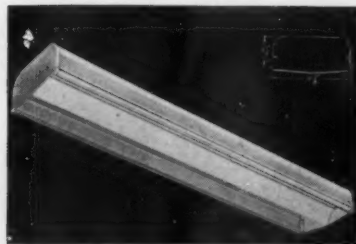
Mechanical interconnection between the Amp-trap unit and circuit breaker makes it impossible to damage electrical equipment by operating on two phases when the third phase faults to ground. Each Amp-trap contains a spring-loaded plunger that is released when the Amp-trap fuses. The plunger in turn actuates the breaker trip mechanism to open all three phases. This feature makes it impossible to reset the circuit breaker without replacing the blown Amp-traps.

The Cordon circuit breaker—for voltages up to 480 volts ac, 3-phase or 250 volts dc—will be available in four frame sizes with continuous current ratings of 100, 225, 400 and 600 amps.

The Cordon circuit breaker maintains all the features of the standard molded case circuit breakers including interchangeable thermal magnetic trip units and choice of rear-connected studs, plug-in mounting or front-connected terminals

for switchboard mounting. Special features such as shunt trip, undervoltage trip, auxiliary and bell alarm switches are available and are internally mounted.

*I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.*



**Lighting Fixture**

(2)

New 5-ft commercial luminaire, "60-T-17" operates either two 40-watt low brightness lamps, or two 90-watt high output lamps. The rolled reeded sides aid materially in luminaire rigidity and provide more comfortable luminaire brightness at normal angles. Separable ends and joiners make the unit adaptable for individual or continuous type mounting. Two types of shielding are available: with longitudinal baffle, provides 5° lengthwise by 40° crosswise shielding, and with steel louver, 25° lengthwise by 40° crosswise.

*Edwin F. Guth Company, 2615 Washington Ave., St. Louis 3, Mo.*

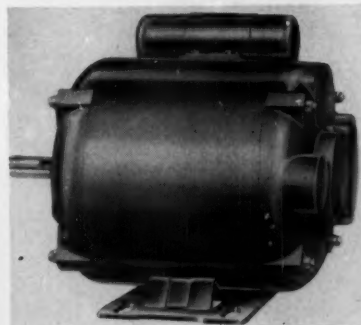


**Lamp for Drafting Boards**

(3)

A new lamp, called Draft-o-Lamp, for lighting drafting and drawing boards, illuminates the entire working area with 100 footcandles. Four feet long, lamp is designed for use with two 40-watt fluorescent lamps. Adjustable for height, unit clamps on back of drafting board, where it is out of the worker's way. Lamp throws a shadowless light, free from glare. Instant starters result in immediate full-board, non-flickering lighting. Bulletin 123 is available.

*Midwest Lighting Products Company, P. O. Box 536, Cleveland 7, Ohio*



**Motors**

(4)

A line of single-phase fractional hp motors with ball bearings and dual-voltage windings. Used for driving air conditioning and refrigeration machines, fans, pumps and blowers, compressors, conveyors, oil burners and other applications in homes, shops and industries, the motors are offered in  $\frac{1}{4}$ ,  $\frac{1}{2}$  and  $\frac{3}{4}$  hp, and 1200, 1800 and 3600 rpm ratings, for 115- or 230-volt, 60-cycle power supplies. All motors are equipped with ball bearings and have aluminum-injection molded, one-piece squirrel cage rotors, dynamically balanced for vibration-free operation.

*ACEC Electric Corporation, 40 East 49th St., New York 17, N. Y.*



**Breathers and Drains**

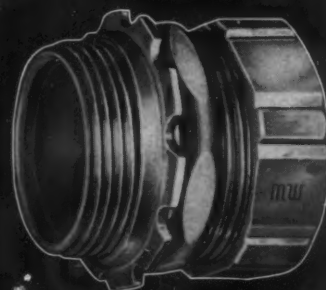
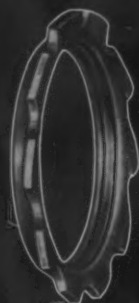
(5)

New stainless steel universal breathers and drains for humid hazardous areas. Type ECD devices are for use on explosion-proof combination starters and circuit breakers and other equipment housings in Class I, Groups C and D hazardous locations. They have two functions: (1) to drain off accumulated water, resulting from condensation, in the base of the explosion-proof housing; (2) to ventilate the housing by allowing constant circulation of air, thus minimizing condensation. Units can be installed in explosion-proof housings by screwing them into hubs or holes tapped from conduit having five or more threads.

*Crouse-Hinds Company, Wolf and 7th North Sts., Syracuse, N. Y.*



MW



• Multiple locking edges for greater bond.  
Assures positive ground for electrical system.

• Spring tension against locking surface  
provides permanent shake-proof installation.

• Reverse bevel on inner surface permits  
bonding edges to be pulled up tight to  
locking surface.

• Up to 66% more driving notches for  
easier working angle, when tightening.

• Heavy gauge steel. Cadmium plated for  
corrosion protection.

## COMPARE THESE *midwest* LOCKNUT FEATURES...

These "Sure Bond" Locknuts are specifically designed to do a better job. Compare these features against those of other types of locknuts. All Midwest fittings, 2" and smaller, come equipped with "Sure Bond" locknuts.

★ Here is another Midwest development in providing quality fittings. "Quality" is just a condensed way of saying: "Getting the total job done—right—with the most inexpensive combination of material and man hours." Engineering and producing quality fittings to meet the highest standards of electrical wiring installations, is our objective at Midwest.

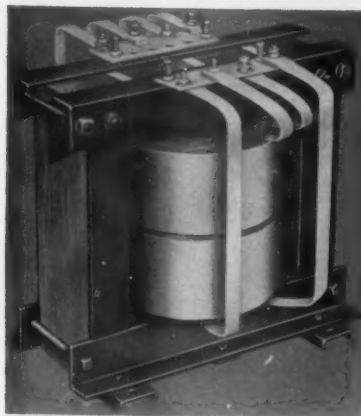
***Midwest Electric Mfg. Company***

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

1639 W. WALNUT STREET

*Chicago 12, Illinois*

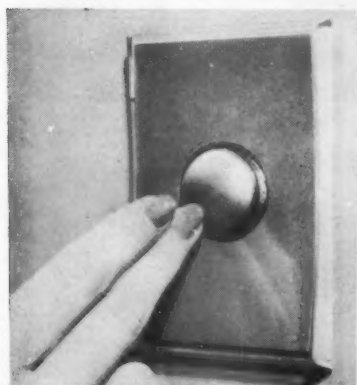




### Aluminum Strip Winding (6)

Thin aluminum sheet insulated by its own oxide provides an insulated conductor for winding transformers, solenoids and other electrical apparatus. The almost foil-thin tape, .004 to .012 inches thick, of the required width is anodized to produce a 2/10,000-inch film of aluminum oxide on its surface. The film of oxide provides the between-turns insulation of a spiralwound, one-turn-per layer, coil. The novel construction permits compact aluminum coils to closely approximate the dimension of insulated copper wire coils of the same capacity and require no increase in equipment size. The aluminum winding is about half the weight of a comparable copper coil.

Reynolds Metal Company, Louisville, Ky.

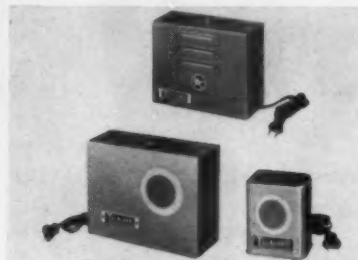


### Wall Switch (7)

A tap-action wall switch called "Tap-Lite," features a slender concave flush-mounted wall plate and a single gold button actuator switch. A light tap of the button makes or breaks contact. All models are UL approved. The washable and craze-proof plexiglas switch plate can be made to harmonize with the interior color scheme of a room through the use of color inserts mounted behind the transparent plate. The inserts are available in four basic colors, can be painted to match other wall shades or used as patterns from which matching wallpaper inserts may be made. The plate is installed

on a spring-loaded clip and can be snapped off the wall for cleaning or redecorating. Switching mechanism is completely sealed from dirt and dust, is fully shock-proof and can be mounted in any desired position.

Minneapolis-Honeywell Regulator Company, 2753 Fourth Ave. S., Minneapolis 8, Minn.



### Fire and Burglar Alarms (8)

A new series of combination fire and burglar alarms suitable for shops, stores and domestic purposes are offered in three unitized models comprising of a master audible alarm signal station, actuated from any number of thermostatic fire sensing detector units placed at critical vantage points. One type employs self-policing closed circuitry for maximum protection either in the event of fire or to signal any break in wiring. Another series offer a fully self-contained battery supply system of circuit closure type—operates independently of any regular current supply. The third series is designed in individual stations for placement at any desired locations and plugs into nearest convenient outlet. All of the fire alarm circuits may be augmented for use as burglar alarms. Bulletin 411-F is available.

Industrial Automation Corp., 2415 W. Montrose Ave., Chicago, Ill.

### Communication System (9)

A new automation intercommunication system providing two-way "private" conversation. Called the Super Chief system, it is operated automatically by voice of user. Available in 10-station capacity, Model ACS-7110, and 20-station capacity, ACS-7120, the Super Chief makes it possible for either party in a two-way "private" conversation to dispense with the manual use of the conventional talk-listen control. The Conference control feature permits "private" conferences between as many as four stations without interference from any other station, and without necessity of any of the parties at any of the stations operating any controls during the conference. Unit also features automatic traffic control, which visually indicates at your station whether the station you have selected to call is "busy"; whether station you have selected to call is "not busy"; or "in conversation", by use of red, green and amber translucent glows.

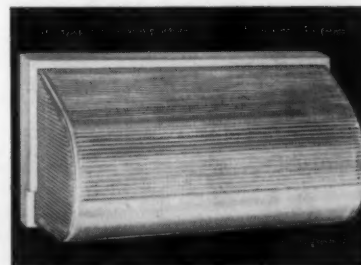
Talk-A-Phone Co., 1512 So. Pulaski Rd., Chicago, Ill.



### Electric Heater (10)

A radiant wall panel that combines mounting ease with an unbreakable, all-metal construction. The design of the heating element gives positive protection against electrical shocks and is completely guarded against moisture and rough usage. Heart of element consists of a nickel-chromium resistor wire packed in a high density insulating refractory and totally enclosed in seamless tubing for positive electrical insulation. A continuous length of this tubing is run back and forth across the back of the radiant heating plate and is permanently bonded to it. Ends of tubular element are enclosed in a built-in terminal box and sealed against moisture leakage. No reflective shield or insulation is required between panel and wall. Panel may be surface-mounted on open walls or under windows, may be recessed against wall studs or to a total depth of 2 3/4 in. Enclosed within the bottom panel frame are a built-in, on-off switch and adjustable thermostat control, plus a line terminal enclosure for connection to power source. Precision wall thermostats are also available, in both line voltage and low-voltage models, to control up to two or three panels from the same thermostat. A selection of several combinations of wattages aid in securing balanced radiation within a room; 1000 watts for use with either 120 or 240 volts ac and 1500 watts for 240 volts ac. Literature is available.

Edwin L. Wiegand Company, 7500 Thomas Blvd., Pittsburgh 8, Pa.



### Lighting Unit (11)

A special lens lighting element, called the Wallens, is designed for wall mounting in homes, hospitals and in commercial corridors. The lens directs the light distribution to a 3-way asymmetric pattern to provide direct and indirect illumination. Its applications include its use as a bed light, over bathroom mirrors, over kitchen work areas and sinks.

Art Metal Company, 1814 East 40th St., Cleveland 3, Ohio



**Here's The Box That  
Is Making Electrical  
Contractors Take Notice!**



CAT. NO.  
5-5-51 • 5-5-71

## **ARROW** **4 1/16" SQUARE BOX**

**The Only Drawn Box  
With More K.O.'s On  
The Sides Than Any  
Other Box Available!**

For general installations where maximum wiring room is required. Depth: 1 1/2" or 2 1/8". Available in any arrangement of K.O.'s up to 1 1/4". As many as 17 K.O.'s. Wiring capacities of 30 cu. in. and 42 cu. in. Hot-dipped galvanized finish is many times thicker than U.L. and Federal Specifications. Write for more complete details.

### **USED IN THESE PROJECTS:**

Statler Hotels in Dallas, Texas, and Hartford, Conn.; Hudson River State Hospital, N.Y.; Fontainebleau Hotel, Miami Beach, Fla.; N.Y. Housing Authority Bldgs.; Various Military Projects; etc.

When you have an installation problem not covered by our standard line, our engineers will design special units to your specifications.



129 30th STREET • BROOKLYN 32, N. Y.

Sales Representatives & Warehouse Stocks  
BALTIMORE, MD. • CHARLOTTE, N.C. • CHICAGO, ILL. • CINCINNATI, OHIO • DENVER, COLO. • LOS ANGELES, CALIF. • MIAMI, FLA. • NEW ORLEANS, LA. • NEW YORK, N.Y. • NEWTON CENTRE, MASS. • PHILADELPHIA, PA. • ROCHESTER, N.Y.



### **Transformers (12)**

A new series of oil-filled distribution transformers, designated as type HJS. Use of Supercore, special grain-oriented steel winding, results in units of lower weight. The newly designed tank, of specially-treated heavy-gauge steel, offers extra resistance to corrosion. It features a high-domed cover held in place with one captive bolt. A re-usable gasket conforms to shape of tank lip. The cases for transformers of 36 1/2 kva and above, feature radiating vanes for heat dissipation. The series is available through 167 kva.

Marcus Transformer Co., Inc., Rahway, N. J.

### **Pink Light Bulbs (13)**

A group of five new decorative light bulbs, known as "de luxe pink bulbs." The bulbs, coated with permanent pink enamel, come in household types of 75, 100 and 150 watts, and in the 25-watt flame-shaped bulb and the 50-GA bulb. They are recommended for ceiling fixtures, portable floor and table lamps, pin-up lamps elsewhere in homes, lounges, clubs, wherever a relaxing atmosphere is important.

General Electric Co., Nela Park, Cleveland 12, Ohio

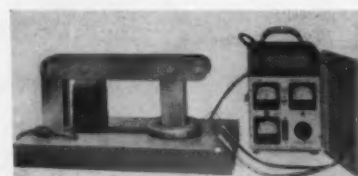


### **Housing for Storage (14)**

"Material Master" is a portable housing for storing materials, tools, and equipment on construction job sites. Unit is specifically designed to be transported by means of a trailer, a wheeled mobile steel structure which embodies the use of a ramp tail gate and manually op-

erated winch. Trailer is hauled from location to location by truck or automobile and is always available for more than one job function. The trailer known as the "Porta-Trailer" is a companion unit to the "Material Master". The entire operation of loading and unloading is performed by one person. "Material Master" is made in lengths of 42 in. to 128 in. Width and height are 45 in. and 50 in. respectively. The 128-in. length is designed primarily to receive and store standard lengths of electrical conduit. The 42-in. length is ideal for storing cartons of outlet boxes, conduit fittings, wire and cable, panelboards, tools, etc. The "Porta-Trailer" mobile unit has an overall loading surface of 130 in. and is designed to transport one 128-in. or three 42-in. "Material Master" units.

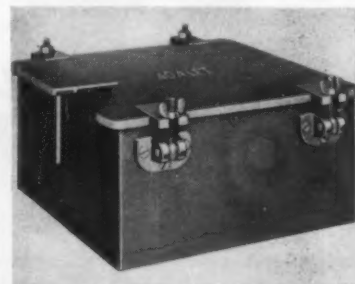
Leonard Electric Company, 3508 Irving Park Road, Chicago 18, Ill.



### **Coil Tester (15)**

A new coil tester, Model 55, is designed for testing field coils, armature coils, transformer coils, solenoids, etc. It detects shorts on one or more turns, detects opens, and shows number of turns in a coil from 10 to 3000. Minimum coil opening 2 1/8 in. by 3 in. by 3 1/4-in. diameter. Maximum coil height 6 in. Operates on 115-volt 60 cycle ac. Transformer base size 12 in. by 24 in.

Martindale Electric Co., 1309 Hird Ave., Cleveland 7, Ohio.



### **Enclosure (16)**

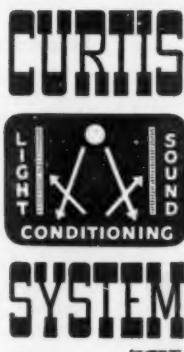
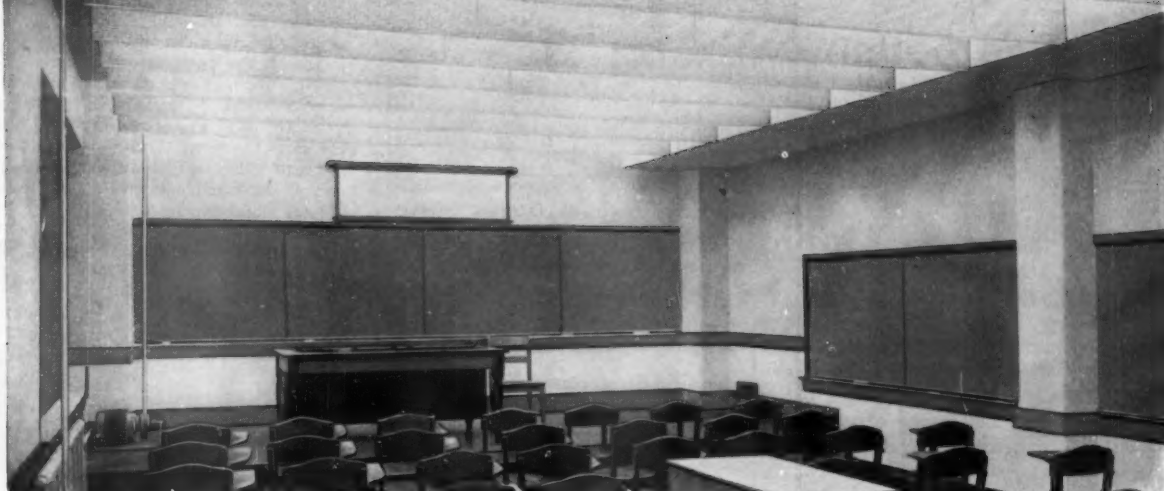
A new hinged-cover type of cast-aluminum-alloy (Adalloy) weatherproof enclosure. Sizes range from small ones to a new one that is 24-in. by 36-in. by 12-in. Standard or special boxes are available. Also, special corrosion resistant aluminum alloys are available for chemical, sewage disposal, marine and similar applications. Catalog Section G-6-55 is available.

Adale Manufacturing Co., 14300 Lorain Ave., Cleveland 11, Ohio.



as quiet as the night

... and as light as the day



**This New Light and Sound Conditioning System Gives the Most Modern Lighting Plus Efficient Acoustical Treatment At Low Installation and Maintenance Cost**

The Curtis Light and Sound Conditioning System provides quality, low brightness illumination and eliminates excessive sound reflections. The Lighting System consists of basic, extension, and wing sections which may be combined to accommodate any size schoolroom, office, auditorium or other interior.

The Sound System consists of vertical panels of high quality acoustical material with a high reflectance, flame retarding, washable finish. The acoustical panels are positioned between 96-inch T-12 fluorescent lamps.

Here is a system that enables contractors to offer both fine lighting and sound conditioning at a low initial cost, low installation cost, low operating and low maintenance cost. Write for further details.

CURTIS LIGHTING, INC.  
Dept. K12-18 6135 W. 65th St.  
Chicago 38, Illinois

CURTIS LIGHTING OF CANADA LTD.  
195 Wickstead Ave.  
Toronto 17, Ont., Canada

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

**CURTIS**

**LIGHTING, INC. • Dept. K12-18 • 6135 West 65th Street, Chicago 38, Illinois**



# PIERCE QUALITY FUSES

**build your  
reputation  
•  
provide better  
protection**



## 10% to 40% Cooler Operation

...assured by Pierce Screen Vented construction. Gases and heat are allowed free escape.

## No unnecessary blows during safe overloads

...thanks both to famous Pierce balanced lag link construction and unique Pierce screened venting.

## No danger of afterblow

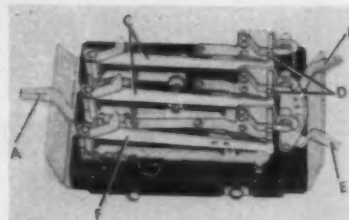
...because dangerous gases and heat cannot build up in the case. Pierce cases last 6 to 8 times longer!

**WRITE TODAY for  
this helpful bulletin  
on lower fuse costs.  
Start NOW to save  
and profit through Pierce  
protection!**

*Also a complete  
line of quality  
non-renewable  
fuses.*



**PIERCE RENEWABLE FUSES, INC.**  
LEICESTER NEW YORK

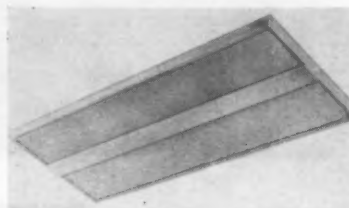


## Thermostat

(17)

New duo-classic thermostat regulates all functions of air conditioning, heating and fan operation at flip of switch. Illustration shows how it works. Lever (A) selects function to be controlled: heat, off, constant fan (no heating or cooling), cooling with constant fan, cooling with automatic fan, and automatic fan. Lever (B) selects the temperature at which the air conditioning unit should operate. Ambient temperatures above this setting cause Chace thermostatic bimetal elements (C) to deflect, making a circuit at contacts (D), initiating the compressors. Lever (E) controls the burner operation in much the same manner. When ambient temperatures are in excess of setting, the Chace thermostatic bimetal strip (F) deflects to break the circuit, stopping furnace operation until ambient temperature drops to the desired level. Literature is available.

*Detroit Controls Corp., 5900 Trumbull, Detroit 8, Mich.*



## Fluorescent Fixtures

(18)

The new "Thin-Lite" series of fluorescent luminaires is now available with Corning No. 70 low brightness lens. It is designed to deliver maximum illumination in useful directions with brightness reduced by prismatic action in glare zone. Designed for installation where surface mounting with a minimum of depth is desired, "Thin-Lite" creates a semi-recessed effect. Its depth below ceiling is essentially the same as that of troffers equipped with dished plastic or glass shields. Literature is available.

*Lighting Products, Inc., Highland Park, Ill.*

## Outlet Cutter

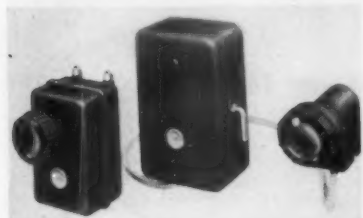
(19)

Perfect die-cut holes for single or multiple switch boxes can be punched in gypsum wallboard with new tool, outlet cutter No. 272. It handles standard wallboard thicknesses: 3/8-in; 1/2-in; 5/8-in. A feature is the winged pilot hole



cutter, which eliminates the need for a brace and bit in getting to outlet box behind the wallboard. Cutter can be used for multiple switch boxes, by the use of a three sided cutting attachment in addition to the regular single-box four-sided attachment. It comes equipped with one 4-sided 2-by 3-in. cutter and one 2-by 3-in. 3-sided cutter. Additional cutters for 2-by 4-in. switch boxes and one 4-in. circular cutter for octagonal ceiling outlet boxes are also available.

The Stanley Works, New Britain, Conn.



#### Control System (20)

A new ready-to-use photoelectric control system, Set P4L, provides increased operating distances plus high speed operation. It operates over distances up to 100 ft and affords speeds up to 600 operations per minute. The long-range set has a remote phototube with an extended lens system. High sensitivity assures positive action under widely varying light conditions and interference caused by vapor or dust. Relay is actuated on completion of beam.

Photoswitch Division, Electronics Corporation of America, 77 Broadway, Cambridge 42, Mass.



#### Lighting Unit (21)

"Series 5" Utilites are particularly adaptable for indoor or outdoor service in coastal or other areas where extreme moisture and salt air are prevalent. Socket housing and mounting arm are chrome plated and unit is furnished with a special Hycar rubber lamp gasket. Mounting base is cast aluminum in black finish and is punched to fit either 3/4-in. or 4-in. outlet box. In addition, unit may be mounted to any flat surface. Equipped with weatherproof cord set. They can be furnished with ground spike for mounting in turf and are adaptable for outdoor holiday and convenience lighting around homes and commercial establishments. Bulletin 1079 is available.

Steber Manufacturing Co., Broadview, Ill.



**"The most outstanding piece of equipment I have ever purchased"**

says C. E. Rose,  
owner, Rose Electric Co.,  
Kansas City, Mo.

## ... new lightweight Greenlee Hydraulic Bender for 1/2"-2" conduit

easily portable . . . makes 90° bend with one ram stroke

"Because it is easy to handle and transport from job to job . . . because it will make a 90° radius bend with one thrust . . . and because of its thin-wall attachment obviating the need for buying manufactured bends, we selected the new GREENLEE No. 880 Bender," says C. E. Rose of Rose Electric Co.

And, since having this new *lightweight* GREENLEE Hydraulic Bender on the job, this company reports substantial savings of man-hours and complete elimination of conduit spoilage and need for manufactured bends.

You, too, will welcome the *easy portability* of this advanced type bender. One man can easily carry and operate it . . . make smooth, accurate bends in 1/2"-2" conduit or pipe in just a few minutes.

With light, but strong aluminum alloy used for many parts, weight of this new tool has been greatly reduced so that it can be carried by hand or

simply pushed along on its pipe supports which serve as rollers.

Two-speed hydraulic hand pump with special speed coupling on the hose and pump means simplified handling, fast setup. And with its attachments for thin-wall conduit, tubing, and bus bar, the No. 880 Bender can make almost any type of bend in *all types of material* within its size range. *A complete 90° bend can be made with one ram stroke.*

Designed for easy hand operation, this new lightweight bender can also be teamed with a GREENLEE Power Pump for fast production jobs. Get the complete story now on this highly versatile new bender, see how it can be one of the best tool investments you've ever made! Write for folder E-217.



GREENLEE TOOL CO., 1750 COLUMBIA AVE., ROCKFORD, ILLINOIS



# 2000 POUND HOPPER CAR JUMPS TRACK ... RAWLPLUGS HOLD IT IN MID AIR SAYS 10 YEAR USER OF RAWLPLUGS

"The height of the pictured stack was 180 feet. The hopper to the right of the stack was in operation and somehow the hopper car wheel became entangled in the rope from the top of the scaffolding. The hopper car, weighing several thousand pounds was suspended freely in the air but in spite of this, the Rawlplugs held.

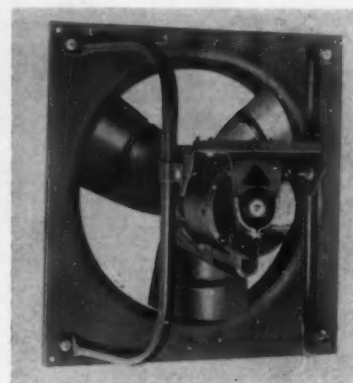
"It was one of those unusual conditions, adding greatly to the stress on the scaffolding and the Rawlplug fastening. We were using  $\frac{1}{2}$ " x  $2\frac{1}{2}$ " Rawlplugs with  $\frac{1}{2}$ " x 4" lag screws to hold a rigid arm fastened to the brick masonry and then bolted to our vertical frame.

"We have used Rawlplugs with lag screws for these fastening operations for at least the last ten years. The safety of the workmen, as well as movement of supplies, is dependent upon our safety and securely mounted scaffoldings.

"We like Rawlplugs for our fastenings because they give us a sure and dependable anchorage and have shown us their ability to withstand those unusual conditions that can occur on a construction job."

F. V. LaMarca  
ADJUSTOMATIC SCAFFOLD CO.  
of PITTSBURGH

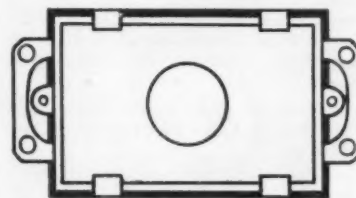
Write for catalog and prices.



**Exhaust Fan (22)**

A new heavy-duty propeller type exhaust fan is designed specifically for industrial use. Designated Model K Ventura fan, the unit is available with 2-speed or constant-speed direct drive totally enclosed motors. A large range of sizes are offered with capacities from 587 cfm to 12,800 cfm. The new design will operate against static pressures up to  $\frac{1}{2}$ -in. A square mounting panel design contributes to ease of installation.

American Blower Corp. Detroit 32, Mich.



**Box Support (23)**

A new one-piece box support designed to simplify installation of switch boxes. Support is a single flat piece of metal, die-cut to receive the switch box and with fingers that bend around to secure it. The single unit, once placed in the wall, holds itself and frees the hands of the electrician to install the switch box. For use in both new and old installations.

Blackhawk Industries, Dubuque, Iowa

**Heating Element (24)**

New Glocoil industrial-type combination receptacle-heating element for electrical or electronic testing and heating eliminates several connections which are often trouble sources in conventional two-piece units. Connection of coil resistance wire to terminals is made within ceramic base, away from the source of heat, the wire being clamped securely between locknuts. Available in standard ratings from 100 to 1500 watts at 118, 220 or 440 volts; non-standard wattages and voltages or special nickelchrome elements supplied on request. Unit, including base,  $4\frac{1}{8}$  in high; base measures  $3\frac{1}{4}$  in. by 2 in.

Ranger Electric Mfg. Corp., 25-38 Astoria Blvd., Astoria, L. I., N. Y.



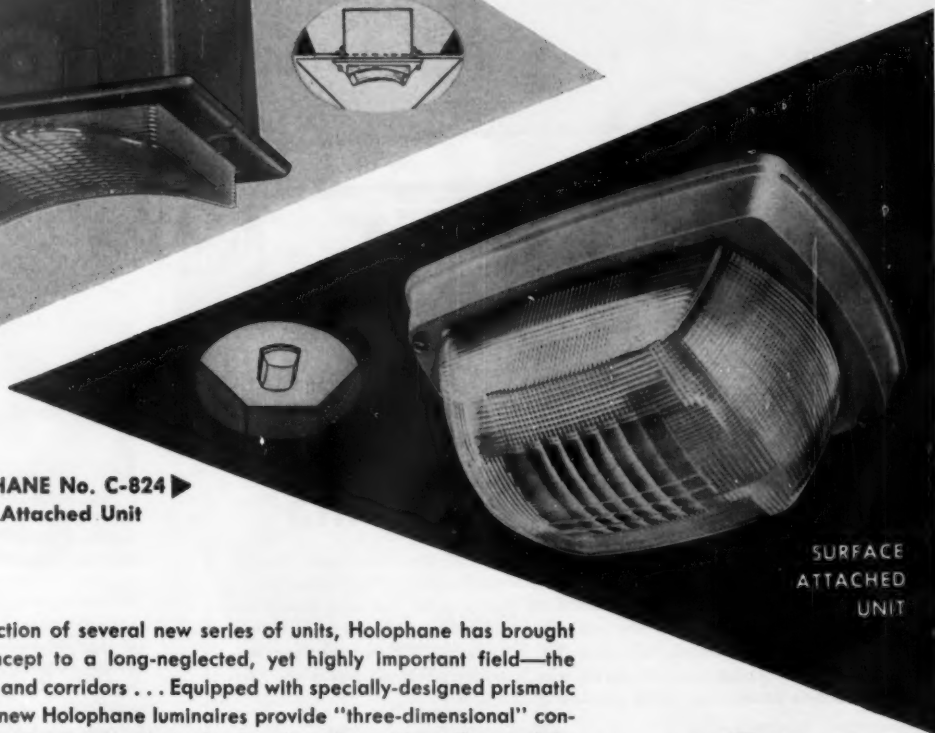
# NEW! 3-dimensional LIGHTING for CORRIDORS

RECESSED  
UNIT



◀ HOLOPHANE F-1823  
Series of In-Built Units

HOLOPHANE No. C-824 ▶  
Surface Attached Unit



SURFACE  
ATTACHED  
UNIT

With the introduction of several new series of units, Holophane has brought a new lighting concept to a long-neglected, yet highly important field—the illumination of halls and corridors . . . Equipped with specially-designed prismatic **CONTROLENS\***, the new Holophane luminaires provide "three-dimensional" control of light . . . directing it not only to the floor but also to the ceiling and the walls. Reflections from these surfaces produce perfectly-balanced, glare-free illumination, resulting in an atmosphere of dignity, safety and visual comfort . . . This is a market that can be most advantageously developed. We invite inquiries for data on F-1823 (recessed) and C-824 (surface-attached).

\*®



For Better Lighting . . . Be Specific . . .

## HOLOPHANE

HOLOPHANE COMPANY, Inc.  
Lighting Authorities Since 1898  
342 MADISON AVENUE, NEW YORK 17, N. Y.  
The Holophane Co. Ltd., The Queensway, Toronto, Ont.



## Communications Contract for a School

### PRINCIPAL'S OFFICE

Central sound and control board - turntable, amplifier, selector board . . . Loudspeaker . . . AM-FM Antenna and receiving system . . . TV Antenna and receiving system . . . Closed-circuit television . . . Private intercom system

### CLASSROOMS

Loudspeaker (possibly with two-way feature) Outlets for

audio-visual aids . . . Outlets for TV Antenna . . . Intercom telephone

### PHYSICAL EDUCATION

Loudspeakers . . . Microphone outlets . . . Turntable

### AUDITORIUM

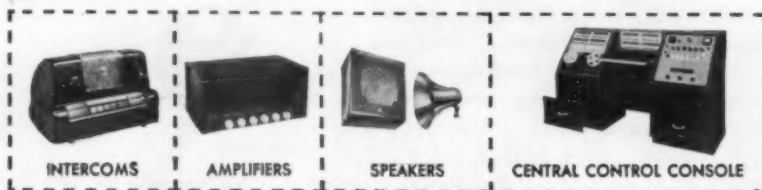
Loudspeakers . . . Microphone outlets . . . Telephone in projection booth



*To meet ALL these requirements  
depend on . . .*

## RCA SOUND SYSTEMS

The name that comes first to the minds of both architects and school officials. Get acquainted with your RCA Distributor and his complete inventory of RCA matched components, designed to help you lay out and install the right sound equipment for any job—from a 6 watt public address system to a combination sound, radio and TV installation. He can supply everything you need plus valuable advice which helps you avoid delays and call-backs. You profit most when you install the best!



SOUND PRODUCTS

**RADIO CORPORATION of AMERICA**  
ENGINEERING PRODUCTS DIVISION CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal



### Timer

(25)

A new electronic repeat cycle timer, suitable for design into automatic machines or for process control. Typical applications include: sign flashing, life testing, bag filling, refluxing and automatic weighing. Design of Model No. 4 timer utilizes an electronic circuit with two cold cathode triodes. Complete, independent adjustability of both on and off cycles from 0.1 - 12 seconds is provided. Output is a single-pole-double throw relay with 5-amp contacts. Timer is available for panel mounting or in a 3-in. by 4-in. by 5-in. box.

G. C. Wilson & Company, 1915 Eighth Ave., Huntington, W. Va.



### Flashers

(26)

A new series of cam-actuated motor-driven flasher units, utilizing mercury to mercury contacts for high current interrupting capacities, are now available from 6 volts to 250 volts ac or dc. Any rate of interrupting or coded flashing cycles can be obtained in standard unitized plug-in type housings—suitable for all-purposes or for Class 1, Division 2, hazardous and corrosive applications. Bulletin M-500 is available.

Industrial Automation Corp., 2415 W. Montrose Ave., Chicago, Ill.

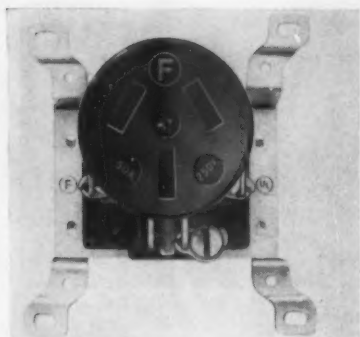
### Fluorescent Lamps

(27)

Slimline fluorescent lamps for stores and offices are single pin based and are available in T8, 1-in. diameter in 72- and 96-in. lengths and T12, 1½-in. diameter in 48-in, 72- and 96-in. lengths. Available in several shades of white, also blue and green.

Supro Lux Manufacturing Co., Inc., 406 East 161st Street, New York 51, N. Y.

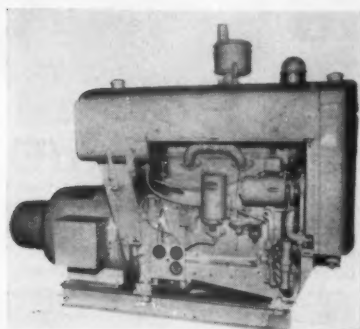




## Receptacle (28)

New, patented swing-away terminals that make one-handed wiring easy have been introduced in two new range and power outlets. With the loosening of a screw, the clamping plate on terminals can be swung out of wiring groove, wire placed in groove, clamping plate returned, and screw tightened to hold wire firmly. No. 3650 receptacle for range and power cords has a heavy steel back plate with knockouts for 3/4-in., 1-in. and 1 1/4-in. conduit; with built-in cable clamp for back or bottom wiring; and with mounting screws. The new flush receptacle No. 3651 has been equipped with these swing-away terminals. This receptacle, like the surface mounting receptacle, has C.S.A. approval, 50 amps, 250 volts.

Circle F Manufacturing Co., Trenton, N. J.



## Generators (29)

A new line of diesel-electric generator sets designed to fill the widest range of requirements in the 8 to 35 kw capacity range. Power is provided by 4-cycle full diesel engines having electric starting on diesel fuel. A 12-volt starting system battery charging generator is standard. The series includes 40 models in 3 speed ranges: 1200, 1500 and 1800 rpm. All have automatic voltage regulators and line voltmeters, as well as voltmeter selector switch and rheostat. Heavy-duty alternator is of the revolving field type with exciter integrally mounted. All sets are designed for continuous duty or for emergency-standby service with line transfer control for automatic starting in event of power failure.

Universal Motor Company, Oshkosh, Wis.

*"Buffalo"*

# FAN-O-GRAM

ON LOW COST VENTILATION

FIRMS BY THE THOUSANDS BUYING VENTILATION THEY ONCE THOUGHT TOO COSTLY. THE ANSWER IS THE NEW, COMPLETE LINE OF BUFFALO PACKAGE PROPELLER FANS, NOW DOING BIG JOBS AS WELL AS SMALL. URGENTLY SUGGEST YOU REQUEST BULLETIN FM-315 AND SEE HOW WELL THESE FANS ARE PERFORMING ON A VARIETY OF JOBS THAT WILL SURPRISE YOU.

BUFFALO FORGE COMPANY

## BELT-AIR FANS HELP RAISE 20,000 CHICKS!

Farms as well as industry and commerce are getting quiet, efficient service from "Buffalo" Belt-Air Fans. A battery of 24" units keep the air fresh in this big poultry house. Belt-Air sizes range from 24" to 120" for 5,000 to 250,000 cfm air delivery. Here's a size range to handle most ventilating and exhaust jobs up to 1/2" static!



## THESE BELT-AIRS VENTILATE A LARGE COLISEUM!

Here's one bank of 72" units exhausting 770,000 cfm from a Coliseum in the south. Another big installation is handling 1,439,000 cfm! Efficiencies are running very high, even where static pressures are involved.



## IT'S JUST THE BEGINNING!

We're constantly developing special models to meet new demands — power roof ventilators — corrosion-resistant, non-sparking and/or high temperature units. Are you taking full advantage of the possibilities? Why not write for Bulletin FM-315 today and look over this increasingly popular line!



## BUFFALO FORGE COMPANY

520 BROADWAY BUFFALO, N. Y.  
PUBLISHERS OF "FAN ENGINEERING" HANDBOOK  
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.  
Sales Representatives in all Principal Cities

INDUSTRIAL EXHAUSTERS BELTED VENT SETS PROPELLER FANS "E" BLOWERS-EXHAUSTERS



**FASTER... SAFER  
LOWER COST  
LUMINAIRE  
SERVICING...**



**with  
THOMPSON  
POLE UNITS AND HANGERS**

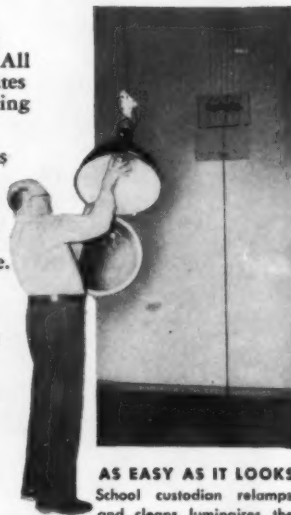
It's easy to maintain inaccessible luminaires at peak efficiency with THOMPSON equipment. All units feature a patented mechanism that eliminates climbing and electrical hazards...makes servicing a simple one-man job.

"SERVISAFE" POLE UNITS are supplied as complete packages ready for wiring and erecting (\*). Single or double-arm models and variety of new steel and aluminum poles can be furnished. BRACKET UNITS for wall and wood pole installations also are available.

THOMPSON HANGERS... for high-bay indoor luminaires... bring lights down to floor level. Variety of models and accessories permits wide range of applications.

For additional details, write for  
BULLETIN WPH-54 ("Servisafe" Units)  
and BULLETIN TH-55 (Indoor Hangers).

\* Luminaires are not furnished in "Servisafe" packages.



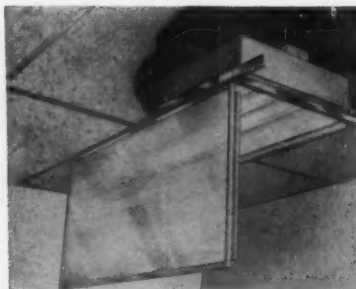
**AS EASY AS IT LOOKS**  
School custodian relamps  
and cleans luminaires the  
Thompson way... with  
both feet on the ground.



**THE THOMPSON ELECTRIC CO.**

1157 POWER AVENUE

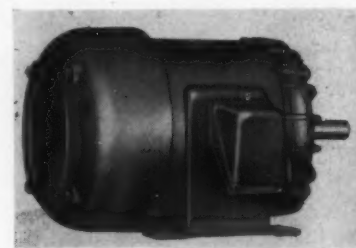
CLEVELAND 14, OHIO



**Troffers (30)**

A new line of 2-ft wide troffers, designed to provide modern, trim and "clean" ceiling effect. Adaptable for installation in any type of ceiling designed for 24-in. troffers, this new recessed lighting unit is supplied with or without integral trim flange. A large selection of shielding media, from louvers and glass to plastic dish, is available. Louvers hinge from either side, and can be completely removed without tools. All glass and plastic shielding is enclosed in door frames, making it simple to remove and replace for cleaning or maintenance.

*Smithcraft Lighting Division, Chelsea 50, Mass.*



**Motor (31)**

New rerated totally enclosed fan-cooled motor line in the 1 to 5 hp series. They are recommended for use in dirty, dusty, fume- and mist-laden atmospheres. Features include: aluminum rotor; ventilating fan designed to provide same efficient operation in either direction, without having to change fan; "six layer insulation" for stator windings; and brackets for holding motor to machine or machine to motor.

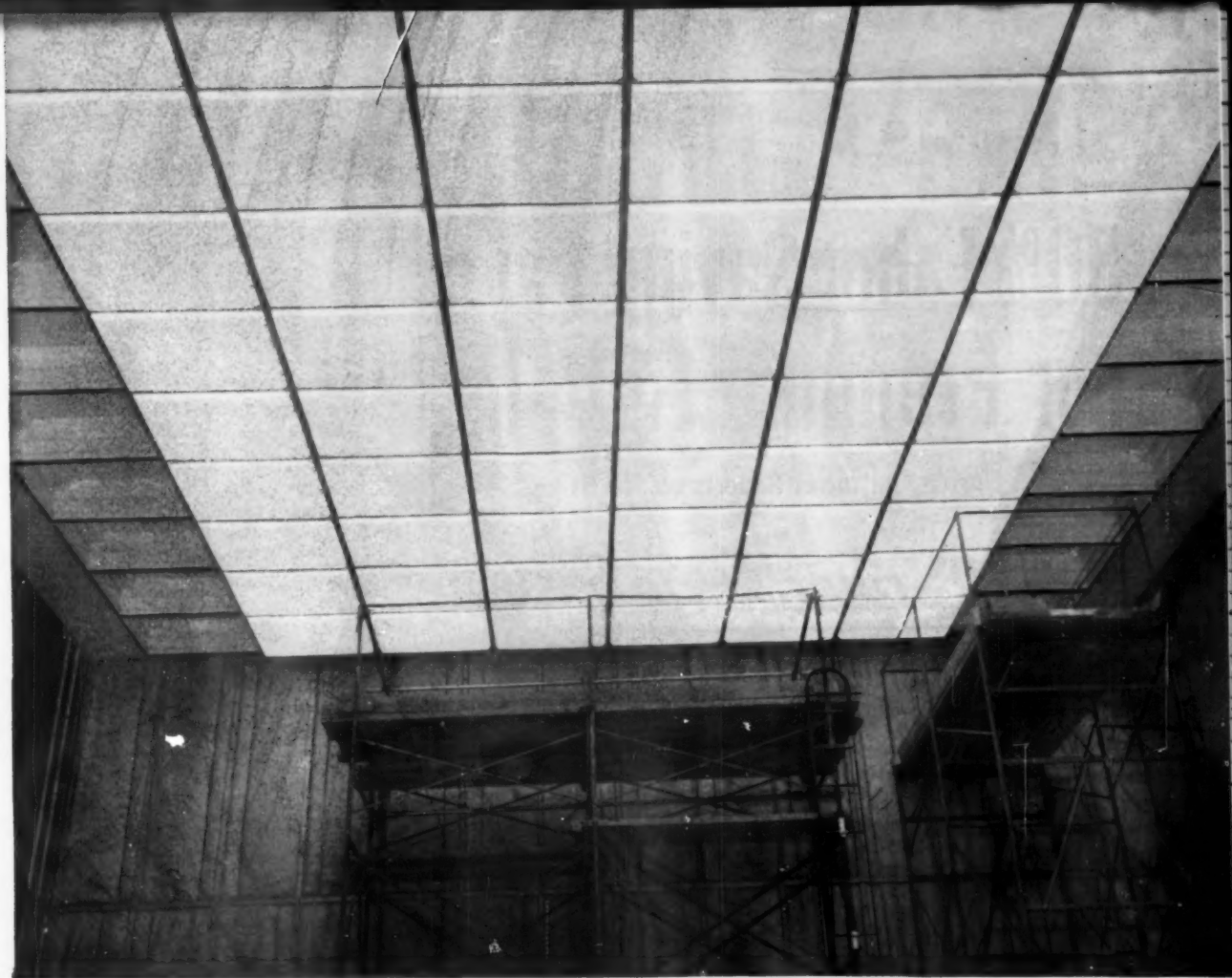
*Century Electric Company, 1806 Pine Street, St. Louis, Mo.*

**Ballast (32)**

A new narrow-cross-section fluorescent lamp ballast for operation of two 96-in. or two 72-in., T-12, slimline lamps. Ballast is 2 in. high, 2-13/16 in. wide and 14 1/2 in. long. Ballast design, Catalog No. BSEQ-275-S, is of the series sequence type, circuit voltage 110-125, 425 ma. It bears the Certified Ballast Manufacturers and Underwriters Laboratories, Inc. labels. Technical data available.

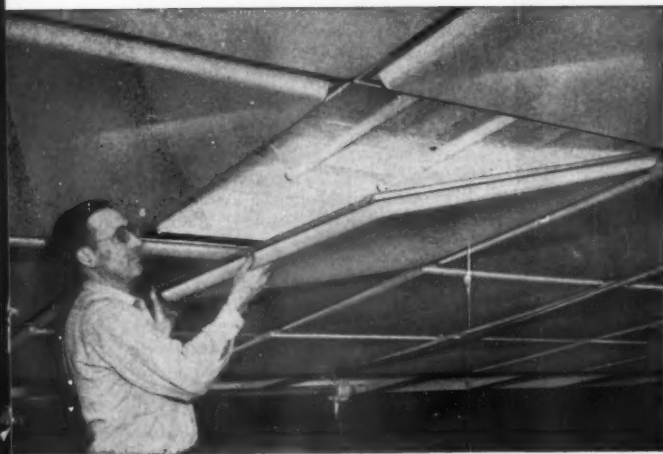
*Advance Transformer Co., 2950 N. Western Ave., Chicago 18, Ill.*





## Going up: another new ceiling of LUCITE®

Extruded "Lucite" acrylic resin assures harmonious lighting with lasting beauty



"Lucite" is readily and economically fabricated to precise tolerances — even broad sections like this 4' x 4' panel. Fixtures of "Lucite" are lightweight for easy assembly, resist discoloration and are durable.

Luminous ceilings produce the highest level of room illumination with the lowest brightness of light source of any existing lighting system. Today more and more architects and lighting engineers use wall-to-wall lighting diffusers made from Du Pont "Lucite" to achieve maximum lighting efficiency. Comfortable environments are the byword with wall-to-wall lighting that harmonizes well with furnishings.

"Lucite" is available in a variety of transparent and translucent colors designed for specific uses. Parts of "Lucite" are economically made to close tolerances. Two principal methods for efficiently lowering the apparent brightness of light sources are through use of clear refracting prisms and white translucent diffusers of "Lucite." They resist discoloration and breakage . . . are lightweight for easy handling.

For further information on "Lucite" acrylic resin, write to E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Dept., Room 4410, Du Pont Bldg., Wilmington 98, Del.

### Good Lighting Is Good Business



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY



**G. S. GRANT, Inc.**  **Electrical Contractor**  
 ST. PETERSBURG, FLORIDA  
 TELEPHONE 7 1095 • 2855 CENTRAL AVENUE • MAY 2, 1955

# 50% Labor Saving Pays For Premium Lighting

... Florida Contractor Reports on Job Using

## GARCY *Speed-Line* System

PATENT PENDING

Here is the contractor's report on an installation of lighting fixtures in a number of Florida schools: "A study of labor costs shows a saving in excess of 50% compared with previous expense." Money saved on installation more than paid the difference in cost between standard lighting and the finest commercial fixture available, the Garcy VISUALIER.

THIS IS  
*Speed-Line*



**FIXTURES ARE PRE-ASSEMBLED AND PRE-WIRED AT FLOOR LEVEL**

No separate external mounting channel needed.



**ENTIRE RUN IS RAISED TO CEILING AS A SINGLE UNIT**

No straining at top of ladders. Fewer stem hangers needed.

**GARCY** *Quality by Design*

Send today for Bulletin 551-L.

**GARDEN CITY PLATING & MFG. CO., 1730 N. Ashland Ave., Chicago 22, Ill.**  
 In Canada: Garcy Co. of Canada, Ltd., 191 Niagara St., Toronto



**Lighting Fixtures (33)**

New Series 7000-RS (and 6000-RS) "T" light fixtures with rapid start lamps for outdoor lighting. They maintain and even increase their efficiency as temperatures drop. New ballasts provide instant and reliable starting, even at zero temperatures. Fixtures are available in 4-, 8-, 12-, 16-, 20- and 24-ft lengths in either 4- or 6-lamp units. Bulletin B18 is available.

Guardian Light Company, 500 North Boulevard, Oak Park, Ill.



**Lighting Fixture (34)**

New Model 505 scalloped Hi-Spot for R30 and 40 PAR lamps is available for decorative interior work. Over-all height of fixture is 6½-in. with a 5½-in. diameter drum. Unit is made of heavy gauge drawn aluminum. It is provided with a plaster ring 5½-in. in diameter and Greenfield. Unit is wired with 4-ft, 14 AF wire, takes a 150-watt lamp. Atlite catalog is available.

Atlas Electric Products Co., 315 Ten Eyck St., Brooklyn 6, N. Y.

**Nurses Call System (35)**

An improved electronic nurses' call system. Features of the combination two-way intercom and signal light system include: a special lavatory emergency button that instantly flashes a patient's call for help throughout all nurses' duty stations; an optional "Staff Director" system which locates and pages key persons; all stations adapted to standard electrical boxes. When a patient originates a call from his bed, the call is registered by both a visual and audible signal. Selector key of his room is lighted at the Nurses' Master Station, and a chime sounds every ten seconds until call is answered. At the same time, corridor lights notify the nurse in the area of the exact room. Simultaneously, a bedside



pilot assures patient his call has registered. Pilot lights and buzzers at all nurses' duty stations also are actuated. Many calls can be handled directly over the intercom, eliminating an errand. Circuit is reset either from bedside unit, or from nurses' master station. Two-way intercom also permits nurses to listen in on seriously ill patients, and to acknowledge their calls promptly. There is a privacy switch on all bedside stations. Each master station has a capacity of 24 selector keys and can be expanded. They measure 14½ in. wide and 9¾ in. deep. Both incoming and outgoing volume are controlled at the Master. Telephone type headsets are used at Nurses' Master Station.

*DuKane Corporation, St. Charles, Ill.*

### Heating Cables (36)

A new series of electric radiant heat cables available in capacities of 300 watts to 4600 watts. They can be used in plaster or dry-wall ceilings as well as in concrete floors. In addition to a special plastic jacket, a second nylon jacket around the outside of the cable prevents any chemical reaction with the plaster in which the cable is embedded and thus eliminates any possibility of streaks in the ceiling. Heating cables are measured lengths of specially constructed and insulated wires; waterproof and non-corrosive. Cable is stapled to the ceiling lath, gypsum board or sheet rock; then plaster or dry wall slabs are applied to it. Literature is available.

*Electromode Corporation, 45 Crouch St., Rochester 3, N. Y.*



### Electric Heater (37)

A new wall mounted panel for electric home heating. Model 1700 has a self-contained thermostat for individual temperature selection, making it especially suitable for hard-to-heat rooms, porches, garages, etc. It uses 120 volts and can be mounted and connected to wall outlet. Frame is of anodized aluminum, and glass is of tempered construction with electric heating circuit fused directly into glass on back. Width is 27½ in, height 20½ and consumes 1000 watts. UL approved. Literature is available.

*Allied Precision Industries, 425 Stevens St., Geneva, Ill.*

# INSUL-8-BAR

## ENCLOSED CONDUCTOR SYSTEMS



**FOR LOW COST  
CRANE AND MONORAIL  
SAFETY ELECTRIFICATION**

**FLEXIBLE** Special engineering is never required. Standard parts are readily adaptable to all conditions, from simple curves to complex switches. Insul-8-Bar can be engineered on the job.



**SIMPLE** Basically, Insul-8-Bar consists of conductor bars with insulating covers (as illustrated), and trolley collectors. Simplicity is coupled with rugged construction.



**VERSATILE** Conductors (see sketches) can be placed as close as 1¼" centers, in any desired arrangement. This is the only system that meets all requirements of crane and monorail electrification. Capacities 50 to 500 amperes.



**ECONOMICAL** Installation and maintenance costs are exceptionally low. Initial cost is well below comparable safety systems. Insul-8-Bar can be applied to existing systems, or installed as a new system. Specify Insul-8-Bar for all crane and monorail electrification needs.

**FREE** Mail coupon for complete information about Insul-8-Bar Enclosed Conductor Systems.



Other Insul-8  
Systems include:  
Bare Bar Systems  
Side Contact Systems

INSUL-8-CORP.  
1285 Rollins Road, Burlingame, California

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**You'll save time, trouble, money**



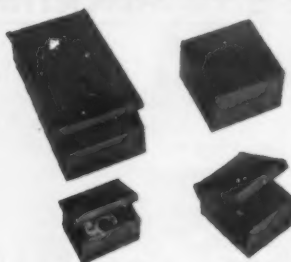
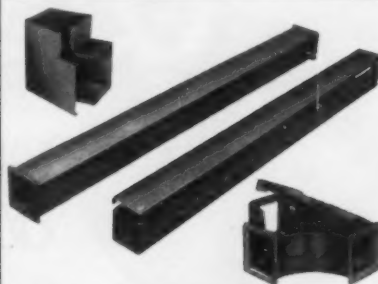
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**KEYSTONE QUALITY LINE**

WIREWAYS AND FITTINGS • CUTOUT AND PULL BOXES  
SWITCH BOXES • OUTLET BOXES • BAR HANGERS



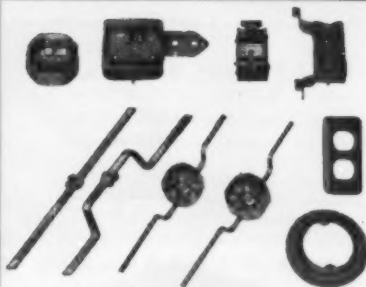
Fishin' for fish is fun! But when you're fishin' for extra profits on wiring installation jobs, the line to use to land your limit is the Keystone Quality Line. Because every item is *priced right* to help you "catch" more jobs. And every item is built right, too, to save you time and trouble... help you "net" bigger profits!

**KEYSTONE WIREWAYS** and Auxiliary Fittings have all the time-saving, money-saving features your customers want. They're quickly, easily installed, readily adaptable to any power distribution system. Available, too, in both flanged and flangeless styles and a wide range of sizes and lengths... from 2½" x 2½" x 1 ft. through 8" x 8" x 5 feet long.



**KEYSTONE CUTOUT BOXES** and Pull Boxes are furnished in Type "A" with hinged cover, Type "SC" with screw cover. Both feature a formed construction strongly fabricated and securely welded... with adequate, easily removable knockouts. And both types are available in a complete range of sizes... stocked for prompt delivery to meet your needs.

**KEYSTONE SWITCH BOXES** and Outlet Boxes are loaded with extra quality features! BX or Romex clamps are already assembled with nested fit for easy pulling of wires. Knockouts and pri-outs come out double quick. And tapped holes are extruded to provide extra thickness, eliminate stripping of threads. Even mounting brackets make installation easier.



New fact-filled, illustrated catalog presents the complete Keystone Quality Line... send for your free copy today!



**KEYSTONE MANUFACTURING COMPANY**

23328 SHERWOOD AVENUE • CENTER LINE (Detroit) MICHIGAN

... the Complete Line of Wiring Installation Equipment  
Sold Only through recognized Electrical Distributors

**Ballast**

(38)

A new rapid-start ballast, designated 89G726, for high-current fluorescent lighting. Designed as an integral part of 800 ma lighting systems, ballast will operate two 96 T12 lamps in indoor industrial and office use at temperatures down to 50°F. It can also be used for operation of two 72T12 lamps in outdoor use, on plastic signs, billboards, and industrial lighting at temperatures down to 0°F. Watts loss on new ballast has been reduced 10%, and over-all length has been cut by 25%, while retaining the same cross section dimensions.

General Electric Co., Schenectady 5, N. Y.

(39)



**WATERLESS** home air conditioners for low and medium-priced homes are available in 1½-, 2- and 3-hp air-cooled models. Unit can be suspended from ceiling of a closet or utility room, placed in an attic or crawl space, or hung from overhead floor joists in a basement. It cools, dehumidifies and circulates filter-cleaned air through the home. Manufactured by Bryant Division, Carrier Corporation, Syracuse, N. Y.

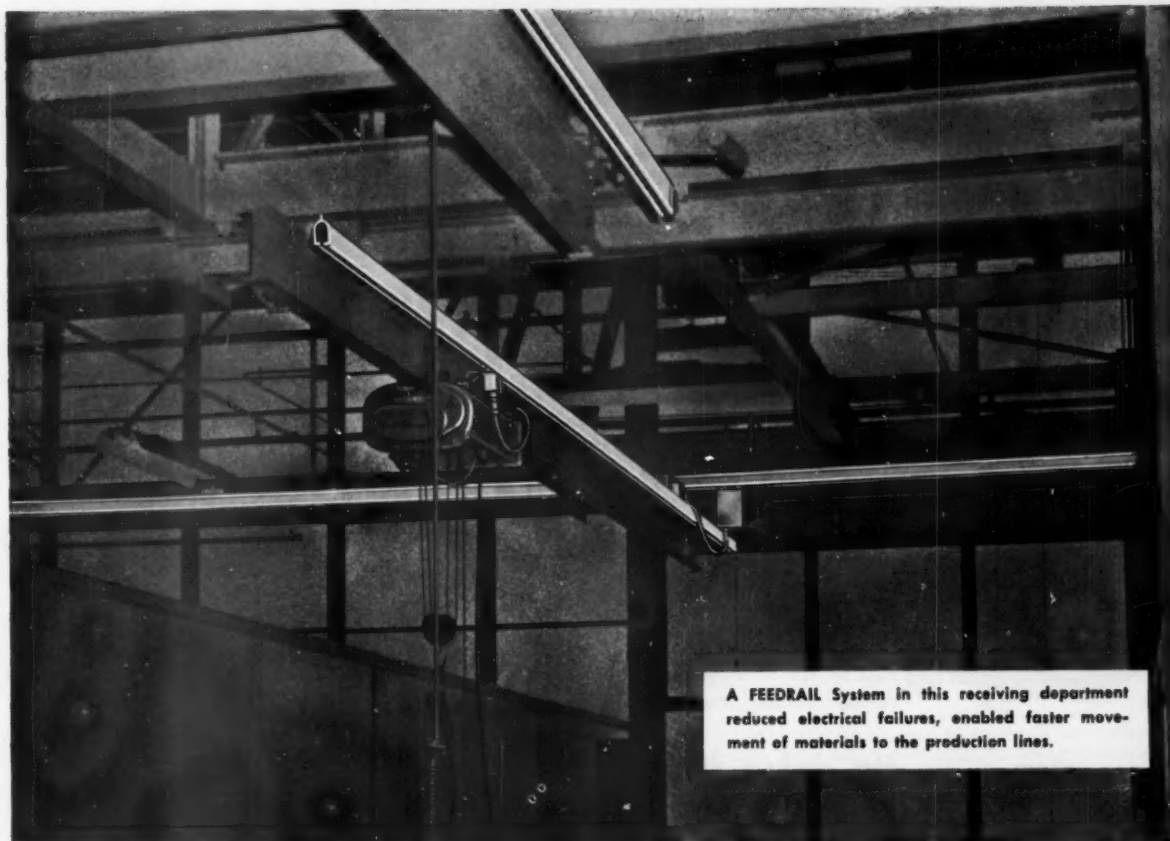


**Lighting Unit**

(40)

A gleaming ball of light throwing rays in all directions from its reflective screen, plus a revolving flash of power from a sharply focused parabolic mirror that turns once every second, known as "Hi-Ball". Light can be mounted anywhere and plugged into any convenient 120-volt, ac outlet. Dome is heavy, non-fading plastic, 9 in. in diameter. Supplied in green, red, amber, blue or clear. Body and base of spun copper, triple-plated.  
Triple Mfg. Co., 218 N. Jefferson St., Chicago, Ill.





A FEEDRAIL System in this receiving department reduced electrical failures, enabled faster movement of materials to the production lines.

## Don't be hamstrung by inefficient electrical distribution

# START NOW TO PROFIT FROM FEEDRAIL'S MANY ADVANTAGES

Take a good look at your electrical distribution system if you want to put your plant operations on a more efficient, more profitable basis. If your present system doesn't provide *mobile* power . . . modernize it . . . follow the trend to FEEDRAIL.

FEEDRAIL is the safe, modern system which solves your electrical outlet problems. Its movable trolley outlets bring power to the point it's needed — *when it's wanted!* It provides a completely reliable means of electrifying moving "loads" — gives greater safety to cranes and hoists — speeds assembly and production operations by enlarging the service area of portable

tools — eliminates troublesome and costly rewiring delays when electrical machines are relocated.

Best of all, its prefabricated unit construction makes installation so simple that you can electrify your entire plant — or a production area at a time — with little or no disruption.

Other advantages: utilizes otherwise wasted head-room; enclosed construction that reduces electrical hazards; clean, modern lines that blend with plant interiors; adaptability that permits it to be easily moved, modified or extended.

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# NEW Blackhawk Service Entrance Head is



## Built-in slip fitter

Just set the housing frame on the unthreaded conduit and tighten the set screws all in a jiffy.

## No extra fittings to juggle

— nor to pay for! The ingeniously simple built-in slip-fitter eliminates extra clamping parts or a separate slip-fitter.

## No thread cutting

Save valuable time and labor and use any rigid or thinwall conduit without threading. Service can be installed close to wall because head slips right on.

Gain time and profits — eliminate thread-cutting and paying for separate slip-fitters and extra clamping parts. Now you can get Blackhawk's simple, neat, complete entrance head that attaches to both thinwall and rigid conduit by just tightening two set screws!

The housing frame is the slip fitter for the new Blackhawk Service En-

trance Head, so there is no need to pay for — and fumble with — separate slip fitters and extra clamping parts. And it's neat — the set screws tighten directly on the conduit, so only the heads show.

The new, completely-protected Blackhawk aluminum Slip Fitter Service Entrance Head is available in all popular sizes.

**Immediate delivery**



# BLACKHAWK INDUSTRIES

DUBUQUE, IOWA

**Specify B-I for quality fittings, built to save you time**



## Combination Fitter and Box (41)

A new cast aluminum combination pole slip fitter and cluster box is designed primarily to provide a sturdy means of mounting clusters of PAR-46 and PAR-56 lamps to the top of 1½-in. or 2-in. pipe. Up to five S-400 or S-410 Steberlites can be attached to the S-345. An aluminum cover, with weatherproof gasket provides entrance to a roomy wiring compartment. The S-345 is equipped with two ¼-in. set screws for secure attachment to pole top. Openings for Steberlites are tapped ½-in. for mounting S-300, S-350 and S-500 as well as S-400 and S-410.

Steber Manufacturing Co., Broadview, Ill.

## Lighting Unit (42)

Jet black weatherproof bullet and fittings designed for thorough weather resistance. Unit is made of non-rusting aluminum throughout, a cast housing and a heavy gage spun shield. It accommodates PAR-38 or R-40 lamps. It is provided with elliptical holes at base of shield to allow a passage of cooling air, drainage of trapped moisture, and a small amount of "up-light". Unit is matched with fittings of same black wrinkle finish.

Rab Electric Manufacturing Co., Inc., 605 E. 132d St., New York 54, N. Y.

## Product Briefs

(43) Diesel Power, Inc., Greenville, Pa., has introduced a new, manually-operated **metal worker** that will bend, punch and shear flat and angle metal bars up to ⅝ths thick and 2 inches wide in flat bars.

(44) A new powder-actuated **stud driver**, Model 455, has been developed by Remington Arms Company, Inc., Bridgeport, Conn. . . . (45) A new self-adhesive electric **heating tape** that may be quickly and easily installed to keep water pipes from freezing has been introduced by the Wrap-On Co., Chicago, Ill. . . . (46) Day-Ray Co., South Pasadena, Calif., has added two new units of 15- and 30-watt size to its line of vapor-tight **fluorescent lamps**.

(47) Three high voltage **Amprobe Junior** models have been added to the Amprobe line manufactured by Pyramid Instrument Corp., Lynbrook,

Patent Applied For.



N. Y. . . . (48) Development of a small-size, heavy-duty limit **switch** designed for control of two independent circuits has been announced by Micro Switch, Freeport, Ill. . . . (49) A new and complete line of fluorescent **transformers** for outdoor plastic signs has been developed by Jefferson Electric Co., Bellwood, Ill.

(50) General Electric Co., Cleveland, Ohio, has announced two improvements to the 96-in., T-12, high-output, rapid-start **fluorescent lamp**. . . . (51) A new "SaberSaw"—**hack saw attachment** for air or electric drills—has been announced by Thor Power Tool Co., Aurora, Ill. . . . (52) Mission Appliance Corp., Los Angeles, Calif., has announced a new "Overhed" **heater-light**—a combination heater, fluorescent circle-light and blower fan.

(53) Lewis-Shepard Products, Inc., Watertown, Mass., has introduced a new "walkie" **electric truck** designed for handling cable reels. . . . (54) A newly designed magnetic motor control **relay** for across-the-line starting of motors, and for industrial control of heating and refrigeration equipment, has been put on the market by the Leach Corp., Los Angeles, Calif. . . . (55) Faries Lamp Division, Elwood, Ind., has introduced a new line of adjustable fluorescent flexible arm **lamps** for use on drafting boards.

(56) Line Material Company, Milwaukee, Wis., has developed a new stainless steel Directolite **reflector**, which is applicable to intersection, and various residential applications where a Type V light distribution pattern is desirable. . . . (57) A new twin **lampholder**, designed in brown molded phenolic by McGill Manufacturing Co., Inc., Valparaiso, Ind., offers a new concept in 3-way lighting. . . . (58) Slaughter Co., 1700 Nicklin Ave., Piqua 20, Ohio, has introduced custom-built municipal **fire alarm** dc power supply units.

(59) General Electric Co., Schenectady 5, N. Y., has developed an automatic outdoor **thermostat control**, which tips off the indoor thermostat to changing weather conditions.

(60) Kato Engineering Company, Mankato, Minn. has announced a new larger series of **generators** ranging up to 500 kva. . . . (61) The new Ebert Micrelay, an all-electronic, ultra-sensitive **relay**, controls 60-amp loads. It is manufactured by the Ebert Electronics Corp., Queens Village, N. Y.

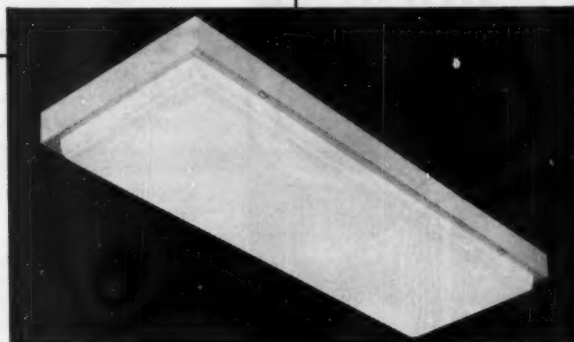
(62) A new low-brightrness curved **lens panel** for fluorescent light troffer fixtures has been announced by Corning Glass Works, Corning, N. Y.

(63) Key-Hak Division, Producers and Distributors, Inc., Allentown, Pa., has announced a new heavy-duty portable electric **hack saw**. . . . (64) An improved photoelectric **control**, designated Autotron Model Fla, for protective as well as repetitive type applications where the phototube normally sees light has been developed by the Autotron Company, Danville, Ill.

# light ILLUSION

END-TO-END or

SIDE-BY-SIDE



## "The Cleveland"

A-15000 SERIES

2, 3 OR 4 LAMP  
LUMINAIRE

- The Cleveland 15000 Series is a classically simple luminaire created especially for surface mounting. Its softly diffused lighting and low lines give it a built-in custom look.
- Flexible end-to-end, side-by-side and individual mounting make possible patterns and banks of unlimited variety.
- One-piece "dished" Acrylic or Polystyrene plastic is held in a rigidized steel channel closure equipped with full-length piano hinges. Spring latches are easy to operate, foolproof and inconspicuous.
- The Cleveland is available in 2, 3 and 4 lamp units wired complete, ready to install. Finished in all white, baked-on enamel. U. L. listed.

Write for Cleveland Specification Sheet.

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HANGERS  
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Mounts Minerallac hangers No. 6 to No. 6 on I-beams safely without necessity of drilling holes. Made of heavy gauge zinc plated steel with deep drawn ribs to give needed strength, these durable, light weight beam clamps have 16-20 tapered holes—will fit beam flanges up to 1/2 inch thick. Furnished with case-hardened set screw. Low cost.

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**MINERALLAC**

# Catalogs, Bulletins and Engineering Data

(65) MICA INSULATIONS in a wide range of forms are described in 14-page booklet M-55. Micabond paper, tapes, plates, sheets and molded forms are detailed as to composition, properties and tolerances. Continental-Diamond Fibre Div. of Budd Co.

(66) ANCHORING DEVICES for masonry and hollow walls are illustrated in 18-page catalog 5504 which gives safe working load, hole size, and prices for all sizes and types. Section on drills covers applications, methods of use and maintenance. Star Expansion Bolt Co.

(67) THINWALL FITTINGS, as well as service entrance and range connectors, a box or fixture hanger for concrete work, and Romex connectors, are featured in a new catalog illustrating the manufacturer's complete line. Tomic Sales & Engineering Co.

(68) EMERGENCY LIGHTING equipment operating on battery power is designed for either permanent connection or auxiliary (plug-in) applications. Diagrams, charts and specifications for the units and a special emergency lighting battery are included in an 8-page Lightguard catalog. Exide Industrial Div., Electric Storage Battery Co.

(69) POWER UNITS for vault installations where space and load growth are problems consist of three or four single-phase transformers and metering transformers in a single tank providing 3-phase or combination 3-phase and single-phase service. All primary and secondary leads are factory-connected to simplify external bus work. Units range from 112½ through 500 kva, 15 kv and below. Bulletin 61B8208, 4 pages. Allis-Chalmers Mfg. Co.

(70) FIXTURE HANGERS. Single stem unit features slotted ceiling strap that permits stems and leads to be connected to fixture channel at floor level. Folder 7-55, 4 pages. Columbia Electric Mfg. Co.

(71) INSTRUMENT SETS for testing, calibration, and coordination of power and distribution class reclosers and other current-actuated protective devices. Specifications for 4- and 7.5-kva portable units are given in

4-page data sheet 4755. Multi-Amp Corp.

(72) RECESSED INCANDESCENT UNITS are illustrated and detailed in loose-leaf catalog Alpha 100. Included is a 21-page section on manufacturer's operations plus a selector guide for all standard units. Marco Mfg. Co., Inc.

(73) TW ALUMINUM WIRE in sizes to 1000MCM is described in 8-page booklet EC-343-55 which gives cost, installation and performance advantages as well as lists of distributors and sales offices. Kaiser Aluminum & Chemical Corp.

(74) ELECTRIC CARTRIDGE HEATER bulletin 850, 4 pages, illustrates complete range of units featuring built-in protection against damage to lead wires by abrasion or flexing stress. Edwin L. Wiegand Co.

(75) FLUORESCENT LAMP BALLAST buyers guide devotes its 8 pages to technical data and operating characteristics of over 180 types of ballasts. Advance Transformer Co.

(76) POLE LINE HARDWARE. Strain and suspension fittings are detailed in 44-page bulletin DL8A which gives brief description of each item in the line along with drawings and dimensions. Line Material Co.

(77) EDGE LIGHTED SIGNS for ceiling, counter, wall or bracket mounting are available with 5-, 6- or 8-in. letterings, single or double faced. 4 page folder. Metallic Arts of New England Inc.

(78) WIRING DEVICES, plates and small portable lamps are among the 1400 items listed in a 68-page catalog. Eagle Electric Mfg. Co., Inc.

(79) VARIABLE SPEED DRIVES. Bulletin 188, 8 pages, covers operating principles and simple method of determining size and type of unit required for the job. Automatic and remote speed control accessories are also illustrated and described. Sterling Electric Motors, Inc.,

(80) ISLAND LIGHT UNITS maintains illumination level at 30 degrees below zero when used with rapid start lamps. Fixtures available in various lengths up to 24 ft. Four-page folder gives dimensions and detailed performance data. Guardian Light Co.



# Is the Certified Lighting Program in Operation in YOUR Area?

**Why don't you investigate this new program that makes selling easier... more effective and more profitable?**

The new Certified Lighting Program operates under the joint sponsorship of electrical contractors, distributors, electric light and power companies, and lighting equipment manufacturers. Its purpose is to guarantee the customer that his new lighting will conform to the published standards\* of the National Lighting Bureau for stores... schools... offices and factories.

If your area is one of the 11 listed below... you can put this program to work for you immediately. If your area is not listed, mail the coupon for the booklet and details of the organizational progress in your area.

\*Based on the published recommendations for minimum lighting levels of the Illuminating Engineering Society.

**11 AREAS ALREADY HAVE THE PROGRAM UNDERWAY!  
What about yours?**



## Certified Lighting

NATIONAL LIGHTING BUREAU, 155 E. 44th St., New York City. Sponsored by the Industrial and Commercial Lighting Equipment Section of the National Electrical Manufacturers Association

**Electrical Contractors... Distributors... Lighting Men:** These Local Lighting Bureaus are activating the Certified Lighting Program in your area. Write for information on Training Courses, Certification, and Promotional Materials.

### LOCAL CERTIFIED LIGHTING BUREAUS

**RHODE ISLAND**, sponsored by the Electrical League of R. I.

**EASTERN MASSACHUSETTS**, sponsored by the Electric Institute, Inc.

**INDIANAPOLIS**, sponsored by the Electric League of Indianapolis.

**SAN DIEGO COUNTY**, sponsored by the Electrical Contractors of San Diego County, California.

**NORTHERN CALIFORNIA**, sponsored by the Northern California Electrical Bureau.

**CHARLOTTE and SURROUNDING AREA**, sponsored by a committee of leaders of various parts of the lighting industry.

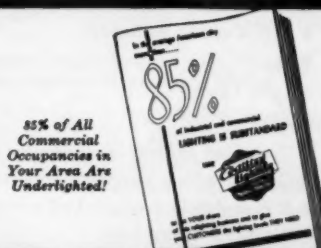
**SOUTHWESTERN OHIO**, sponsored by the Cincinnati Electrical Association.

**FORT WORTH**, sponsored by Fort Worth Electric Club.

**MIDDLE EASTERN MICHIGAN**, sponsored by the Electrical Association of Detroit.

**CHATTANOOGA**, sponsored by the Electric League of Chattanooga, Tennessee.

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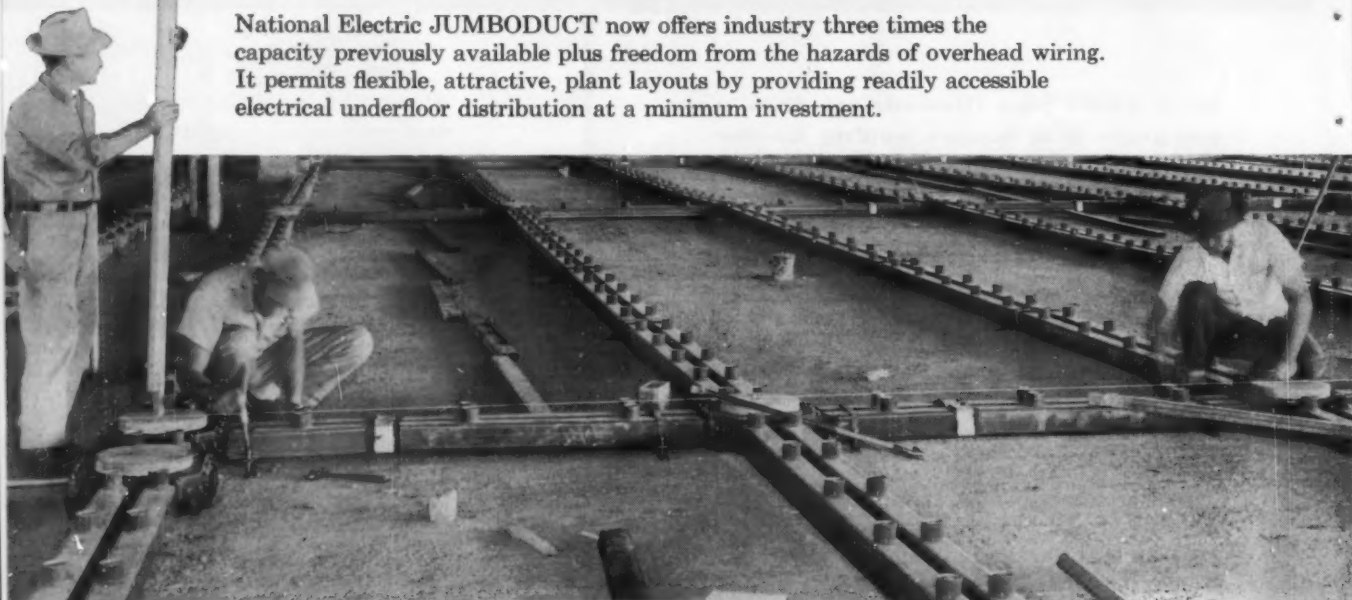


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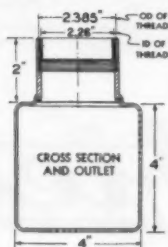
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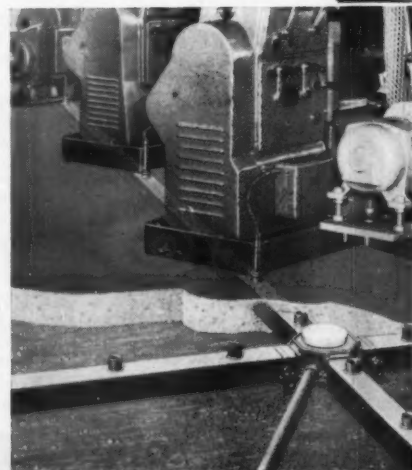
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# Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay \$5.00.

## Generator Capacity And Motor Starting

**QUESTION R28**—We operate a 5000-kw condensing turbine at 5000-kw and a 2500-kw back-pressure turbine at 1250-kw; both 3600 rpm, 80% pf, 2300-volt, 3-phase, 60-cycle, in parallel with the load utility. Our motor load includes two 1000-hp, 2-step, part-winding-start synchronous motors as well as a number of 600-hp across-the-line-start synchronous motors, driving high-inertia loads. We use a frequency relay to trip load in excess of the capacity of the generators in event of utility failure. In such a case, when the generators are operating fully loaded, independent of the utility, and one of the larger motors stops, should we attempt to restart the large motor? Is there some empirical rule for determining the ability of a generator to start a motor without dropping the voltage to such an extent as to lose all the load?—W.E.T.

**ANSWER TO R28**—There is no empirical rule to predicting the transient stability of an electric power system, because the load characteristics of the system, which have an important influence during normal and emergency operation, are not usually known accurately due to their composite nature. However, the effect of these composite loads is in general to produce a stabilizing effect on the system in that a sudden change in load does not require its total amount be picked up immediately by the generators. This inherent resiliency of a loaded system increases the stability margin for suddenly applied loads.

Although not specifically stated, the non-condensing unit is probably on back-pressure control, and the condensing unit on frequency control. The condensing unit is probably operating with constant rated field excitation, and the non-condensing unit is on voltage regulator control. Upon starting of a large motor during a heavily loaded condition, the condensing unit will pick up the power load, and the non-condensing unit the voltage load; the under-frequency relay should be set to ride through a reasonable period of time without tripping. Tripping of the relay will increase the stability of the system, but will cause inconvenience.—J.S.

**ANSWER TO R28**—The speed of operation of protective relays will determine if main circuit breaker will trip out. Find out what time-current curve and time frequency curve are for relays either from manufacturer, person who set relays or from nameplate of relay.

If the individual motors have under voltage relays or releases, their voltage time curves will determine possibility of losing load if the larger motors are started without their mechanical load.

If your relays are of the adjustable type and they are set for fast operation, whether it would be advisable to increase their time would depend on the ability of the particular generators and turbines to safely carry a temporary overload for a longer time.—E.B.

## Identifying a Motor With Six Brush Holders

**QUESTION S28**—Please explain the operation and type of a motor having nameplate data of 115-volt, 1-phase, 13 amps, and six brush holders. The motor has forward and reverse directions.—J.B.K.

**ANSWER TO S28**—Since the nameplate labels this motor as single-phase it is an ac motor. This motor can be a repulsion type or a repulsion start induction run motor. If a repulsion motor, the brushes are connected together by a low resistance and ride continuously on the commutator, short circuiting the rotor windings.

If the brushes ride on the commutator continuously and at about 70% speed a centrifugally operated short circuiter is employed to short circuit all of the commutator segments, it is a repulsion start induction run motor.

The most popular repulsion induction motor employs a commutator short circuiter and a brush lifting mechanism, the brushes being lifted from the commutator at about 70% rpm.

However, a repulsion start induction run motor has been built which differs from the described motors in that a squirrel-cage winding is buried beneath the armature winding with characteristics similar to the before mentioned motors but has

somewhat reduced starting torque and with the absence of the pull-in torque.

These motors can be reversed in direction of rotation by shifting the brushes so that a mark on the brush shifting mechanism coincides with a mark CW or CCW on the motor frame.—B.A.S.

**ANSWER TO S28**—This is evidently a 1-hp, 115-volt, repulsion-induction motor. From the information you give I cannot tell whether it is repulsion start-induction run or repulsion start-repulsion run. The difference between the two I have named is that with the repulsion start-induction run there is a centrifugal switch arrangement to short out the brushes, or rather short the commutator segment, at around 2/3 synchronous speed, then the motor runs as a true induction motor.

A repulsion-induction motor has high starting torque due to the armature winding being shorted by the brushes. With the brushes in line with the stator the armature current is in excess and the torque is zero. As the brushes are shifted 15°-25°, maximum torques are obtained for starting. A shift in one direction produces a forward rotation while a shift the opposite way produces a reverse rotation. The number of brushes depends upon the number of poles of the motor. Your motor is evidently six pole, 1200 rpm.—W.E.G.

## Oil-Filled Transformers VS Dry Type

**QUESTION T28**—Having installed a number of transformer vaults with oil-filled transformers and associated secondary switchgear and also load centers with dry type transformers, I would like to know what is the deciding factor in the use of either.

A hypothetical case I have in mind is a school with a 300-kw load. In this case what determines whether a transformer vault should be built and oil type transformers used or whether a load center with dry type transformers without a transformer vault should be used? Also interested in what is the determining factor for other loads.—F.D.

**ANSWER TO T28**—I would not consider the selection of dry type or



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oil-filled transformers entirely dependent upon size. Both are used extensively in all sizes. Actually there are several more important factors which must also be considered. First and foremost, are oil or dry type transformers preferred? An oil filled transformer will handle overloads much more readily than will a dry type, an important asset if heavy load growth is expected. Nor are they as sensitive to ambient temperatures as are dry types, and are to be preferred if the transformer location is not well ventilated.

On the credit side for dry type transformers, they are lightweight, relatively inexpensive, and very dependable if not overloaded. They present very little fire hazard and may be located near the load without a fireproof vault. They are light enough to hang overhead, clearing valuable floor space, and can be used with unit switchgear to make a load center.

The balance of these factors will determine which type is best for the job.—D.H.N.

**ANSWER TO T28—**Transformer selection is largely a matter of economic consideration. Safety is a secondary consideration with modern transformers since fire and explosion is a remote possibility when the units are properly protected and maintained. All economic factors must be considered and correctly evaluated, including first cost of the transformer, costs of installation, maintenance, losses, and depreciation. In some cases noise may be a factor. In indoor applications, oil-filled transformers cannot usually be considered since fireproof vaults must be built to enclose them. Correspondingly, in outdoor applications, the ventilated dry-type usually is not economical since a special weatherproof structure must be provided for it. Oil transformers have the lowest first cost. Dry type transformers have the lowest maintenance cost. Losses are usually the same, as is voltage regulation. Due to the long, actually unknown, life of both types, depreciation is not a significant factor. Switchgear costs for equal types are the same. Installation costs for field assembled equipment will normally be the same as the premium cost of factory assembled equipment, however factory assembled equipment will not only appear more attractive, but offers more reliability.—J.S.

### Size of Disconnect For Capacitor Bank

**QUESTION U28—**What are the minimum requirements for a discon-



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Since it is difficult to predict the outcome of capacitor charging current peaks, a variable range is permitted by the code. A trial and error method of fusing would be in order so as to obtain the least amount of





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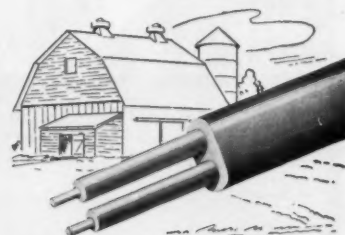


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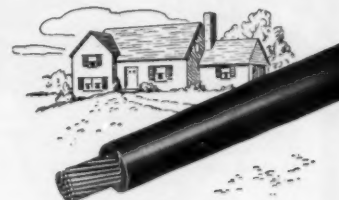
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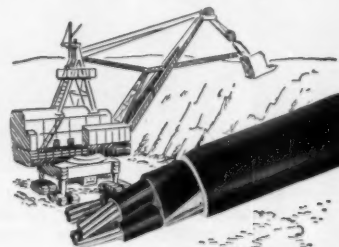
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If at 250% of rated load, with the safety switch fused with 400-amp fuses, the circuit is still needlessly interrupted, a check should be made with the capacitor manufacturer to obtain his recommendations.—W.V.W.

## Can you ANSWER these QUESTIONS?

**QUESTION E29**—How often should elevator cables be inspected? How do you determine the proper cable tension? What is the best method to determine whether the cables are safe?—L.W.F.

**QUESTION F29**—We have a bank of transformers and a bank of capacitors connected in parallel on a 3-phase 7200-volt line, each with its own set of disconnects. When it is necessary to open the disconnects for servicing this equipment which disconnects are opened first, the one for the transformers or the ones for the capacitors?—J.J.L.

**QUESTION G29**—When operating a 60 cycle 440-volt magnetic coil to 120 cycle 440 volts must the coils be wound for the new frequency, or will they operate the same. Are 120 cycle coils obtainable? I saw not so long ago a 12 lead motor operating on 220 or 440 volts to a drum controller and a six terminal double throw switch to change the voltage.—V.S.

**QUESTION H29**—On a 550-volt 3-phase line, we found a wandering intermittent ground from one-phase to ground. This phase to ground voltage would wander from 220 volts to 550 volts, very rapidly, several times in a minute. On this line we had a great deal of trouble with a 15-hp motor that kept burning up. The phase to phase voltage remained stable, even though the ground was wandering.

Have any readers had such an experience where motors would burn up from rapidly wandering grounds? I believe that the trouble with the motor arose from capacitive currents through the motor varying through the winding inductance and thus causing high momentary surges in the motor insulation. But I would like to have some other opinions as this is a common fault and unfortunately a costly business—rewinding 15-hp motors.—H.H.S.

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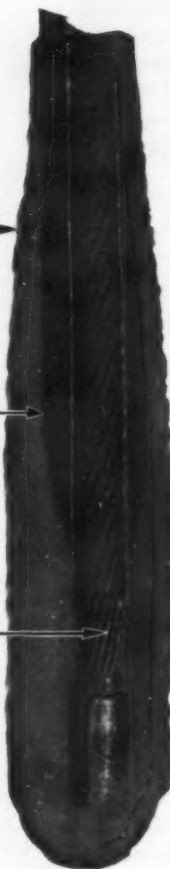
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# Questions on the Code

Answered by

**B. A. McDONALD**, New York Board of Fire Underwriters, Rochester, N. Y.

**GLENN ROWELL**, Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.

**B. Z. SEGALL**, Consulting Electrical Engineer, New Orleans, La.

## Conduit Threading

**Q.** Why doesn't the Code specify that conduit couplings shall be tapered  $\frac{1}{8}$  in. per ft as the taper on the conduit? Up to now all conduit is furnished with straight couplings giving only  $2\frac{1}{2}$  threads engaged when the Code calls for five in Section 5014a.—G.O.

**A.** I suppose the Code could have such a requirement. There seems to be some difficulty in obtaining taper threads in straight through couplings although I understand taper threads can be obtained from some manufacturers.

Seemingly the  $2\frac{1}{2}$  threads, as you state, does give satisfactory operation. This question has been discussed at some length in this column (see ECM January 1953 and June 1953). Opinions are somewhat divided as to the advisability of setting up a rigid requirement for a standard thread taper. Some people in the field have had difficulty in making up connections where all tapered threading was used, especially at point where conduit fittings had to be placed in the conduit lines in a specific position.

Incidentally, several IAEI Chapters have passed resolutions requesting that the respective Code Panels study this problem and include this standard thread taper as a code requirement if it is at all practical to do so.—B.Z.S.

## Transformer Installation

**Q.** A factory in our city has in the past been supplied from a bank of pole-mounted transformers. The power demand is now in excess of the capacity of these transformers so they are being replaced with new units of greater capacity which we would like to locate at ground level and enclose within a small building to be used only as the transformer and service building for this factory, which is comprised of several buildings. As these new transformers will operate at 13,800 volts on their primaries, we are wondering if it is necessary that

this transformer building be constructed as is required for transformer vaults?—L.D.H.

**A.** Under paragraph d. of Section 4523 you will note permission to use a detached building which does not need to conform with the provisions specified in the Code for transformer vaults provided neither the building nor its contents present a fire hazard to any other building or property and provided further that this building is used only in supplying electric service and is accessible only to qualified persons. If these provisions are complied with, the building may be of any construction you choose to use. However, we would recommend that it be of noncombustible construction.

While you did not state the kva rating of these transformers, we assume because you do not wish to pole mount them they are of considerable size and if that is the case, some means of confining the flow of oil should one of these transformers rupture should be provided for unless the service building will be down grade from all the buildings in that vicinity.—G.R.

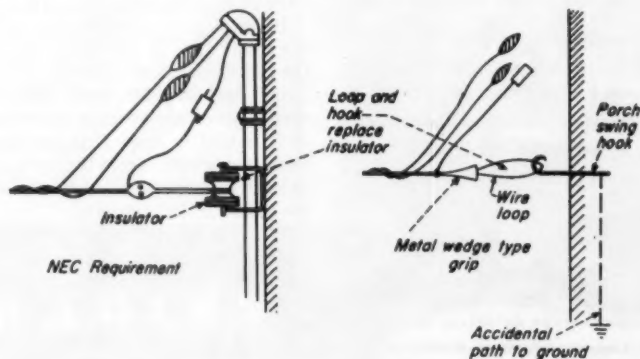
## Service-Drop Supports

**Q.** I have a code problem which I presented at a meeting of our Chapter of the IAEI at Tulsa, Okla. All present agreed with my interpretation of Article 230, but no one could say why the rule was made.

The problem has to do with the method of terminating self-supporting

3-conductor service drop cable by the local division of the utility company serving our town. I am enclosing distribution Standard D661 which I think meets code specifications as to termination. The 1953 revision eliminates the insulator and replaces it with a metal hook, (porch swing hook). The utility company contends there is no sense in the rule for an insulator inasmuch as the service conduit is electrically a part of the neutral wire.—I.R.C.

**A.** It appears to me that the method shown by the diagram, which involves the use of a metal hook in place of an insulator, promotes a hazard and would conflict with the Code requirements for grounding covered by Article 250. I assume that the hook is screwed into the frame of the building and the ground wire is looped around the hook. Such a combination could provide a parallel path to ground which due to the poor connection at the hook and the nature of the accidental path to ground would create arcs and sparks. During a lightning storm it is quite possible that this path to ground would be taken, and if so, this arcing path to ground could easily start a fire and the hook connection due to poor contact would be destroyed. Perhaps the hook contacts a nail, conductive insulation, a metal pipe or any material which supplies a path to ground. I personally believe that the possibility of establishing a parallel path to ground is evident and that a fire is not only possible but probable when a combination such as shown is used.



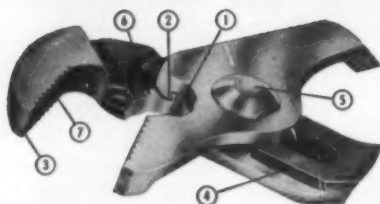


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Article 250 of the Code requires an ac system to be grounded at each individual service to a standard electrode by fittings that assure a low impedance and continuous path to ground. The installation shown, in my opinion, violates this concept of grounding for protection. I do not believe we may compare the proposed method with that of the bare grounded neutral in the conduit. I realize that such an installation does promote poor contacts between the conduit and the neutral unless solidly bonded together and grounded to one electrode. If this electrode fails we have another usually at the transformer to provide the required protection.—B.A.McD.

## Sign Branch Circuit Load

**Q.** Section 2125b limits branch circuit loading to 80% where operation will be for long periods such as store lighting. How does this tie in with 6006 for branch circuits in signs? Signs may have loads up to 15 amps per circuit. Are they not considered in use for any long periods of time? Why the discrimination between them?—D.I.

**A.** Refer to Section 1104. You will note that this section of Article 110 states that the provisions of Chapters 5, 6 and 7 are

1. supplementary to, or
2. amendatory of

the general provisions of Chapters 1, 2, 3, and 4 and this is important, the provisions of Chapters 1, 2, 3 and 4 apply under such circumstances except as so amended for particular conditions.

In my opinion, the intent is to limit branch circuit loading to 80% of the branch circuit capacity for operation of the sign (or outline lighting) for "long periods of time", in accordance with the requirements of 2125b. Section 6006, however, just places a further limitation with respect to those branch circuits feeding only sign loads, viz., only 15-amp branch circuits may be used.

If the sign is a flasher type or moving figure type or for short time usage the full 15-amp capacity of the branch circuit may be used. Even under these conditions of use we must exercise care as it is well to know that we may expect some trouble from the overcurrent protective devices when these devices are loaded to full capacity.

When a constant load sign or outline lighting is to be installed I feel sure that the intent is to keep all branch circuits feeding these loads at the 80% maximum figure (12 amps) or less.—B.Z.S.

## Wiring For Filling Station

**Q.** We are about to wire a number of new filling stations where they are erecting in addition to the service building a display building which will house the service station office and a display room for the display of their premiums. The vent pipes for the underground gasoline storage tanks are located at the rear of this building and terminate about 4 ft above the roof of the building. This office and display building is more than 20 ft distant from any of the gasoline dispensing islands but because of the location of the vent pipes, it is our contention this building is within the hazardous area and must be wired accordingly. Are we correct in this assumption?—O.C.S.

**A.** Yes you are correct inasmuch as Section 5120, paragraph 6. 2. states very definitely "in any outside location, any area including buildings located within 20 ft horizontally from any dispensing island or pump, or from any tank fill-pipe or tank vent-pipe, shall be considered to be a Class I, Division 2 location which shall extend upward to a level 18 in. above driveway or ground level." Therefore, any electrical equipment located within this office and display building which is placed within 18 in. of the driveway or outside ground level must be of the type suitable for use in a Class I Division 2 location. Actually, areas adjacent to the vent pipes at modern filling stations are probably more hazardous than any other portion of the filling station property due to the fact that it is common practice today to use tanks of 5,000 gallons capacity into which considerable amounts of gasoline are placed at one time, so whenever these tanks are being filled an appreciable amount of gasoline vapor is expelled and could, with wind conditions being right, form flammable vapor-air mixtures in the vicinity of the vent pipes.—G.R.

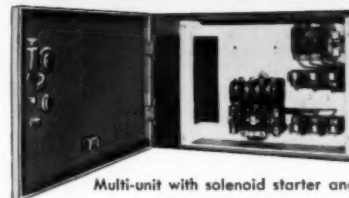
## Number Conductors in Conduit

**Q.** We notice in the heading above Tables No. 4-11 (numbers of conductors in conduit) that these tables apply only to complete conduit system and do not apply for short sections used for protecting exposed wiring from mechanical injury. Please explain this.

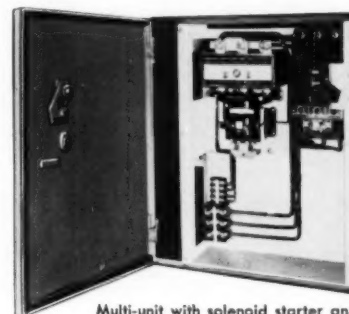
In regard to the above would it be permissible, for instance, to put six



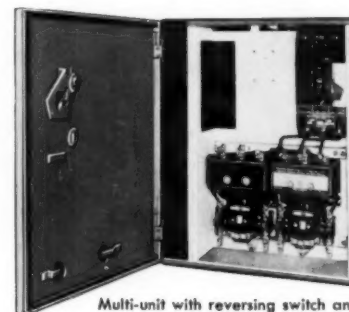
A few of the many standard units available for A-B Control Centers...



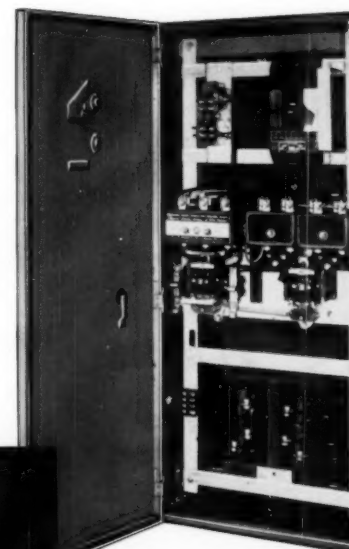
Multi-unit with solenoid starter and fused manual disconnect.



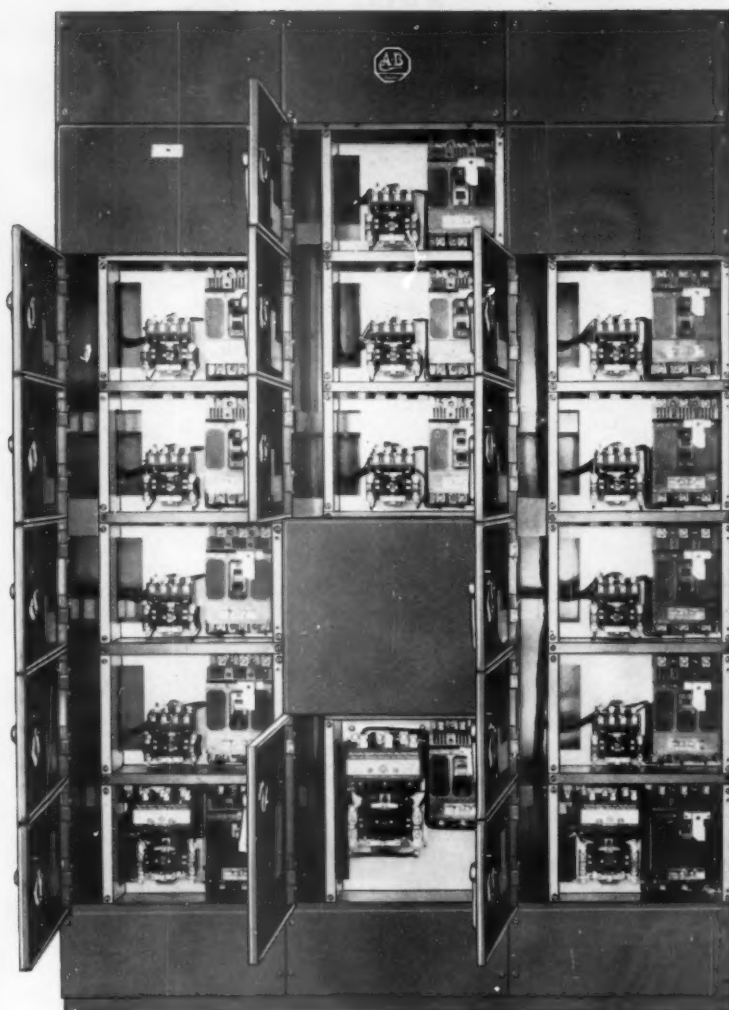
Multi-unit with solenoid starter and circuit breaker.



Multi-unit with reversing switch and I-T-E instantaneous breaker.



Multi-unit with autotransformer-type automatic motor starter.



## Allen-Bradley Control Centers

Into these multi-unit control centers is engineered all of the quality for which Allen-Bradley controls have earned their established reputation. The complete story is told in our 28-page bulletin on Allen-Bradley Multi-unit Control. It is a handy guide that will answer your questions about the various standardized units that

will usually fit your specific motor control requirements.

Manual or automatic motor starters, reversing switches, relays, timers, circuit breakers, autotransformers, pilot lights, push buttons—all are built into sectionalized Allen-Bradley units, listed and described in Bulletin 798. Send for it, today.

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BULLETIN 798 MULTI-UNIT CONTROLS  
QUALITY



# The Quality Line of Manual Motor Starters



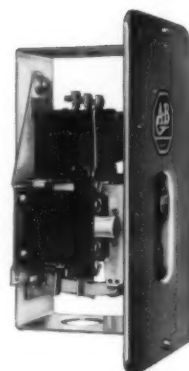
GENERAL PURPOSE



WATERTIGHT



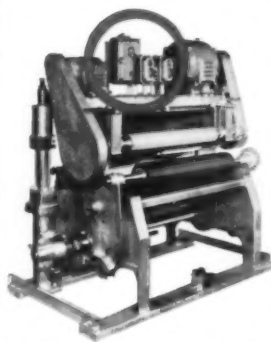
EXPLOSION-PROOF



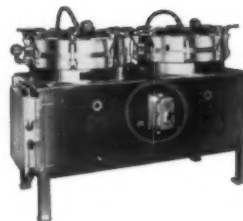
FLUSH TYPE



A-B manual starter, in NEMA 1 general purpose enclosure, on DeWalt metal cutter.



A-B manual starters, in NEMA 4 watertight enclosures, on Stehling fleshing machine.



A-B manual starter, in NEMA 7 explosion-proof enclosure, on Hilco oil reclaimer.



A-B manual starter, in Type 1B1 flush mounting, on Noble & Westbrook shell marker.

The popularity of Bulletin 609 manual starters rests on the following facts!

- 1—They are so simple. Few moving parts mean few chances for trouble.
- 2—Quick-make and quick-break switching action prevents contact "teasing."
- 3—Double-break, silver alloy contacts need no cleaning or filing—they are always in perfect operating condition.
- 4—Use of "buttons" for ON and OFF



Bulletin 646 auto-transformer starter.

switching is in line with operation of automatic starters and is convenient for machine operator.

- 5—The two solder-pot overload breakers provide continuously dependable and accurate motor overload protection.

Be sure to send for a bulletin describing the full line of A-B Bulletin 609 manual across-the-line starters up to 5 hp, 220 v; 7½ hp, 440-550 v.

8-55-MR

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**ALLEN-BRADLEY**

SOLENOID STARTERS

QUALITY



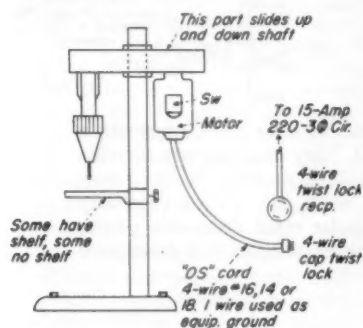
No. 14 wires through a ½-in. nipple from one panel to another with nipple 6 inches long?—F.W.

**A.** The note applying to Tables No. 4 to 11 only applies to exposed wiring such as is involved with open wiring on insulators covered by Article 320. As an example, Section 3212-d, open wiring on insulators, recognizes the use of conduit which may be used, as an example, for protecting exposed wiring that passes vertically through floors and require protection up to a distance of 7 ft above the floor as covered by Section 3213.

This exception to the requirements to Tables No. 4 to No. 11 does not apply to nipples of a conduit system and therefore your proposal to use six No. 14 wires in a ½-in. nipple would not, in my opinion, satisfy the Code requirements. A 1-in. nipple as covered by Table No. 4 would be required.—B.A.McD.

## Machine Tools—Flexible Wiring

**Q.** Many drill presses may be moved up and down, and electrical "OS" cord, due to its flexibility, lends itself very readily to drill press operation. If Greenfield is used, constant up and down adjustments usually loosen the connectors and fray the wires. May cord be used in such cases?—P.P.G.



**A.** Assuming that the drill is fixed equipment which does not come under any of the exceptions applying to the use of cord as covered by Section 4003, it appears to me that the use of cord for the purpose outlined would be questionable. The newly recognized "Liquid-Tight Flexible Metal Conduit" as covered by Article 351 seems to satisfy the various problems involved with the installation shown. In addition to the flexibility

required special attention has been given to the design of the fittings used. It's liquid-tight jacket affords protection when exposed to oils. It is approved by Underwriters' Laboratories for use in wet locations and where exposed to mineral oils. It appears to me that it would satisfy the various objections you have raised with respect to the use of flexible conduit. I suggest that you contact your local electrical distributor or the American Brass Company at Waterbury, Conn. for all the details involved with its construction.—B.A.McD.

## Street Lighting Installation

**Q.** A contractor is just now finishing the installation of street lighting in the business section of this city and there is some question in my mind as to whether or not I can OK this installation due to the fact he has located several lighting standards adjacent to filling stations where the standards are within 20 ft of the gasoline pumps and he has not used explosion-proof wiring in the bases of these lighting standards. Is this not a violation of the Code and how must the wiring be fixed to fully comply with Code requirements? At the present time this wiring consists of Type UF conductors buried from one lighting standard to another and the base of the lighting standard contains a fuse cutout block at which this Type UF wire terminates.—G.R.C.

**A.** Under paragraph b. 2. of Section 5120 you will note that in an outside location any area within 20 ft horizontally from any dispensing island or pump, or from any tank fill-pipe or tank vent-pipe, shall be considered a Class 1, Division 2 location which shall extend upward to a level 18 inches above driveway or ground level. Then under paragraph b. of Section 5014 you will note that in Class 1, Division 2 locations threaded rigid metal conduit, or threaded electrical metallic tubing conforming to section 3487 shall be the wiring method employed. To comply with the Code regulations, it would be necessary that the fuse cutout base be mounted more than 18 inches above the driveway or ground level and that the Type UF conductors be contained within either rigid metal conduit or electric metallic tubing between this cutout base and a point at least two feet below ground level. Sealing fittings would not be necessary but the electric metallic tubing or rigid conduit should terminate with bushings at both ends.—G.R.



Dependable, low-cost space heating where and when you need it

## CHROMALOX Electric COMFORT HEATERS

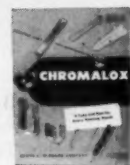
You have a choice of blower, convection or radiant types of heating, all with Chromalox totally enclosed heating elements. Portable, mounted or built-in units—¼ to 40 kw. Automatic or manual controls.

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- ☐ a copy of Catalog 50
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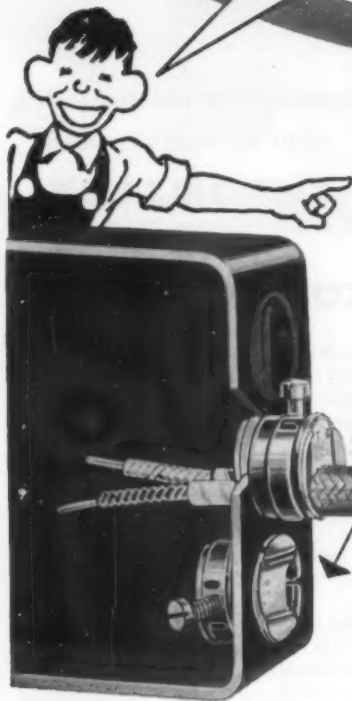
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

A-4471A



MAKE INSTALLATION JOBS  
EASIER, MORE CONVENIENT...

Only  **2020\*** connectors  
have all these cost-saving  
features!



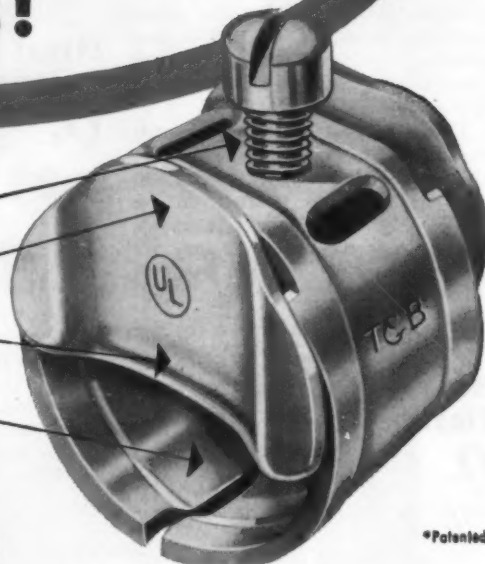
Only one screw to  
tighten . . . captive so it  
can't come out

No lock-nut needed —  
grooves hold connector in  
 $\frac{1}{2}$ " knock-out

Smooth, firm grip on all  
cable sheaths

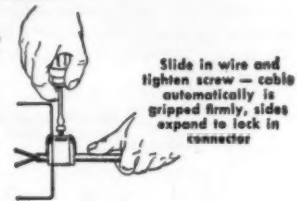
Takes 2- or 3-wire non-  
sheathed metallic cable in  
sizes from 14-2 to 10-3

Easily installs from out-  
side or inside box



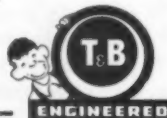
\*Patented

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T & B 2020's are steel snap-in type connectors for non-metallic sheathed cable. With an easy squeeze, the "2020" snaps into a  $\frac{1}{2}$ " knock-out and is held fast by grooves. Because this connector installs from either inside or outside the junction box, it is especially good for work on old buildings where damage to walls and floors can be avoided by working from inside the box.

T & B 2020 Connectors have full Underwriter's Laboratories approval. They hold any non-metallic sheathed cable sizes 14-2 to 10-3; 2- or 3-wire cables, also portable cords, etc. — work especially well on currently popular small dimension plastic sheathed cables. Write for samples and descriptive literature.



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The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs.

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## Time Delay Fusing

**Q.** One fuse manufacturer states that fusetrans are protection against single phasing conditions on motor circuits. Does the code consider this so?—T.S.

**A.** The Code does not specifically state so, in so many words. However, from a practical and an engineering standpoint this is true, provided the proper size of "fusetrans" is selected.

For example, a 10-hp, 3-phase, 240-volt, 60-cycle, standard squirrel cage induction motor will nominally have a full load current rating of 27 amps. Under ordinary conditions we would use a fuse rated at least

$3 \times 27$  or 81 amps  
or a 90-amp size for the branch circuit protection and a thermal element of  $1.25 \times 27$  or  $33\frac{1}{4}$  amps  
for the running protection of the motor. Thus, if the motor tends to run at an overload, these thermal devices will open the motor circuit before the motor overheats.

It is possible under certain conditions of "single phasing" to have two phases of this motor drawing approximately full rated current and the third phase drawing about twice normal current. We have a condition here where it is possible to burn out the motor even though the installation is strictly in accordance with the Code. If the thermal elements are in only two phases, as they usually are installed for 3-phase motors, it is possible to have the overloaded third phase without running protection. The branch circuit protection being at least three times the rated current will not "blow" with only twice rated current flowing.

Using time delay type fuses, such as the "fusetrans", we may have within one unit overcurrent devices which protect for "short circuits" and for overloads. Thus, for example, in the case of the 10-hp motor described above we could use a 30-amp "fusetrans" in the main disconnect switch. Since three fuses would be used in the main, there would be protection on all three phases. The same would be true, of course, if we use three thermal elements in the controller.

For normal service these fuses will protect the motor and the circuit for short circuit troubles and will also permit the motor to come up to normal speed at starting. This is made possible because of the inherent longer time lag built into these fuses. This longer time lag permits overloading the fusing during the period required to bring the motor from standstill to full running speed. For long periods of overload the fuse would "blow" in time to prevent overheating.—B.Z.S.

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*Certified* **66**

NEW 66%  
NEOPRENE JACKET  
portable electrical  
cords and cables

*another first from* **BRONCO**

Bronco does it again! Bronco gives you another first!

Bronco made the	<b>1<sup>ST</sup></b>	standard stock portable cords and cables with NEOPRENE jackets!
Bronco was	<b>1<sup>ST</sup></b>	to make cables with protecting jackets containing a high percentage of NEOPRENE!
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Bronco was	<b>1<sup>ST</sup></b>	to BRAND® all cords and cables at two foot intervals.
Bronco was	<b>1<sup>ST</sup></b>	to bring you SYNCHRO-TUNED cords and cables!
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**NOW, BRONCO MAKES HISTORY AGAIN WITH BRONCO 66 CERTIFIED**

The all new Bronco 66 Certified portable cables and cords are protected with jackets certified to contain not less than 67.32% NEOPRENE. For toughness and flexibility, this rich new jacket puts Bronco **FAR IN THE LEAD!**



TURN PAGE FOR DETAILS



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by a registered  
professional engineer  
to contain  
not less than  
67.32% new Neoprene

We certify that the jacket of all cord  
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Certified" contains not less than 67.32%  
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*Edwin*  
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NEOPRENE JACKET

positively identified  
cords and cables

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Never before—not even by Bronco—has so much Neoprene been successfully put into a portable cable jacket. You get more for your money—more Neoprene—more protection. Now, all the things that Neoprene has always done so well are done even better by Bronco 66 Certified.

Bronco 66 Certified is a safer cable—a product of greater value to you. Because it contains more Neoprene—more than any other cord or cable on the market—it gives greater protection against OIL, GASOLINE, KEROSENE, FLAME, SUNSHINE, OZONE, HOT, COLD, WATER, ABRASION, SCUFFING, TEARING, CRUSHING, IMPACT, RATS AND GREY RATS, ACIDS, ALKALIS, HEAVY DUTY of the elements found in industry that are the natural enemies of cords and cables.

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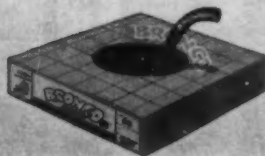
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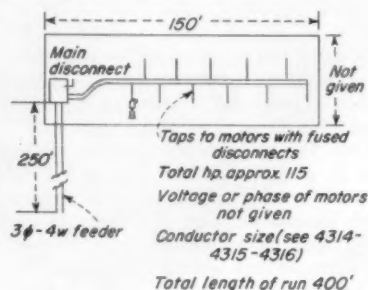


with knock-out top—for  
convenient dispensing.  
Keeps store room neat.  
Notice king-size label for  
cross-the-room reading.

increased flexibility, too!

## Motor Wiring Proposal

**Q.** Recently, I was presented with the job of installing two separate feeders to two rooms. All I've been told is that each room will have about 40 to 45 machines, individually driven. The approximate total horsepower for each room is in the vicinity of 115 horsepower. The motor sizes will range from  $\frac{1}{2}$  to  $7\frac{1}{2}$  hp. Neither room will ever run more than  $\frac{1}{3}$  of capacity due to the nature of the set-up. As these machines will be wired piecemeal I want to bring my feeders to a main disconnect in each room and then run the entire length of the room without reducing the size of conductor throughout. Then, tap off for each individual motor having its own fused switch. This will be a 3-phase, 4-wire 208-volt system. Length of run from supply to each room about 250 ft. Length of each room about 150 ft. As I am basically trained for elevator controls I would like any information you may care to send me.—J.H.C.



**A.** I have shown by Fig. No. 1 the method you propose for serving the motor load involved, as I understand it. While your proposal for running a feeder from the source of supply 250 ft to a main disconnect and then continuing down the length of the building a distance of 150 ft with taps to the individual motor loads, may be installed to satisfy Code requirements, there are several rules involved which I believe will be cumbersome to apply. Since the motors are all connected to one feeder and each motor circuit is protected by a switch and fuse we have a situation similar to a panelboard where the panel bus extends the length of the building but we do not have the facilities of a panelboard for making the motor circuit connections to the bus or feeder. Section 3434 covers the size of the 25 ft tap that could be recognized and it must be of a size at least one-third of the conductor to which it is connected. It is quite obvious, when connecting a  $\frac{1}{2}$ -hp motor to the feeder that the tap required would be very large in comparison with the motor load and it would be difficult to make a proper connection at the fused switch protect-



ing the motor circuit. It is also noticeable, as the load connected to the feeder continues to decrease as we travel the length of the feeder, the necessity for the full copper capacity continues to decrease. It also follows that the longer the feeder and the more connections involved, the possibilities of faults are increased and when a fault does occur all of the motors connected to the feeder will fail to operate. When the feeder is short with few connections the chances for failure are less and you have more assurance of continuous operation. This point should be considered if you wish to avoid the costly loss of production and manpower when a feeder fails.

It appears to me, since 40 to 45 machines and motors are involved that two or three panelboards should be installed at load centers with individual motor branch circuits run to each motor, with the exception of fractional hp motors which may be grouped on one motor branch circuit. I believe, if all of the factors are properly evaluated that you will find such procedure to be the most efficient and economical in the long run.—B.A.McD.

### Service Disconnect

**Q.** Does Section 2351 permit six circuit breakers to eliminate a main line fuse? Does the Code make any provisions of where or how near the source of supply the main line switch should be placed?—R.R.M.

**A.** Yes, under the condition stated. Thus in a single occupancy as stated in 2351a, a maximum of

1. six switches or six circuit breakers in a common enclosure, or
2. six switches or six circuit breakers in a group of separate enclosures may be used in lieu of a single disconnect. All the other requirements of 2351a have to be complied with.

In a multiple occupancy building we may go even further in this subdivision of service without a main switch. If the building is two stories or less then we may have

1. any number of sets of service entrance conductors tapped to one service drop, or
2. any number of sub sets of service entrance conductors tapped from a single set of main service conductors.

Each of these sets of service entrance conductors or each of these sub sets of service entrance conductors may have six or less switches or circuit breakers as outlined for the single occupancy building above. In other words a multiple occupancy building which is two stories high having say ten individual tenants, may have a

# NEW SYNCRO-CURE!

makes it possible to put 67.32% Neoprene into...



## BRONCO Certified 66

NEW 66% NEOPRENE JACKET

portable electrical cords and cables

BRONCO 66 CERTIFIED 67.32% NEOPRENE TYPE G 3 COND. 6 500 V P1168M

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You can actually see a new texture—a new look of quality reflected in the smooth, tough hide of Synchro-Cured Bronco 66 Certified. Black and rich, the Certified jacket gleams with quiet strength, ready flexibility. Tests have proved that Bronco 66 Certified is 20.33% more flexible than the average of all competitive cords tested, including widely-advertised brands.

The increased flexibility which results from the new Synchro-Cure process increases the value of Bronco 66 Certified to you:

- 66 Certified flexibility lessens worker fatigue...**
- Stays put; doesn't snake its way under the business end of cutting tools...**
- Lies flat; eliminates hazard to traffic.**

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**BRANDED\***... Every 2 feet, vulcanized into the jacket, appears "Bronco 66 Certified—67.32% Neoprene" type, number of conductors, size, voltage, and P1168M—approval number of the Pennsylvania and U. S. Bureau of Mines.

**BRONCO 66 CERTIFIED** is made in a full range of types and sizes:

TYPE	SIZES	COND.
SO Cord	18-10	1 to 4
Control Cable	18-10	5 to 24
W or G	8-1/0	2 to 4
Single Cond.	18-4/0	
Welding Cable	8-4/0	

also Type SJO and SV-Neoprene

**Another first from BRONCO!**

\* PATENT PENDING



2

NEW

# FLUSH-TYPE POWER OUTLETS FOR DRYERS

flat strap mounting speeds installation

## NO. 3860 FOR SINGLE GANG BOX

### features...

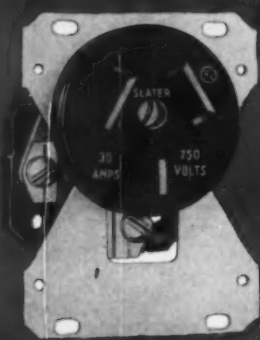
Phosphor Bronze Contacts  
Clamp Elevator-Type  
Terminals  
Patented Revolving Rear  
Plate  
Back Wired  
Sturdy Construction  
Nema "L" Shaped Slot  
30 Amp/250 Volts  
U/L Approved



## NO. 3840 FOR DOUBLE GANG BOX

### features...

Phosphor Bronze Contacts  
Clamp Elevator-Type  
Terminals  
Easily Removable Multiple  
Knockouts  
Back Wired  
Sturdy Construction  
Nema "L" Shaped Slot  
30 Amp/250 Volts  
U/L Approved



NO. 734

## 3 WIRE DRYER CORD SET with "L" shaped slot

### features...

Molded On Rubber Cap • Finger Grip Head  
Extra Strong Brass Blades • Coded Conductors  
Nema "L" Shaped Plate • Lengths up to 36 inches  
Designed for Heavy Duty • 30 Amps/250 Volts

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# SLATER

LIFETIME WORKING DEVICES  
SLATER ELECTRIC & MFG. CO. INC.

maximum of six switches or circuit breakers for each tenant without requiring a main disconnect for the entire building. Thus a total of 10 times 6 or 60 subdivisions of service would be allowed.

If the building is over two stories in height and individual tenants must be served on these other floors with their individual service equipment, then all the service equipment for the entire multiple occupancy building must be grouped in a common accessible place and the main switch can consist of only six or less switches or circuit breakers. Thus a 12-story building with 10 individual tenants on each floor would have to have one main switch or breaker for the entire building or we could install, say six main switches or breakers, each of these to feed 20 tenants on two floors. At each individual tenant service entrance we could of course have as many subdivisions of circuits as we want since the rule applies to the service only and not to the subsequent feeder or branch circuits.

Section 2351 in its general requirement states "Each set of service entrance conductors shall be provided with a readily accessible means of disconnecting all conductors from the source of supply". The definition of "readily accessible" in Article 100 is quite clear.

In addition 2351a states for single occupancy that the disconnecting means shall be "located at a readily accessible point nearest to the entrance of the conductors, either inside or outside the building wall". In 2351b for multiple occupancy buildings it is only required that each occupant "have access to his disconnecting means".—B.Z.S.

## Service Equipment

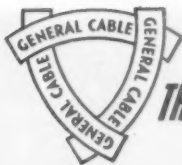
**Q.** We are bringing service into a building at 4160 volts, entering a regular transformer vault where the voltage will be reduced to 230/115 4-wire system. Can we place the service switch and overcurrent protection on the primary side of this transformer if we use equipment suitable for this voltage?—M.O.

**A.** You will find an explanatory note preceding Section 2386 of the Code which indicates when the service equipment can be placed in the primary and when it cannot as this note reads as follows:

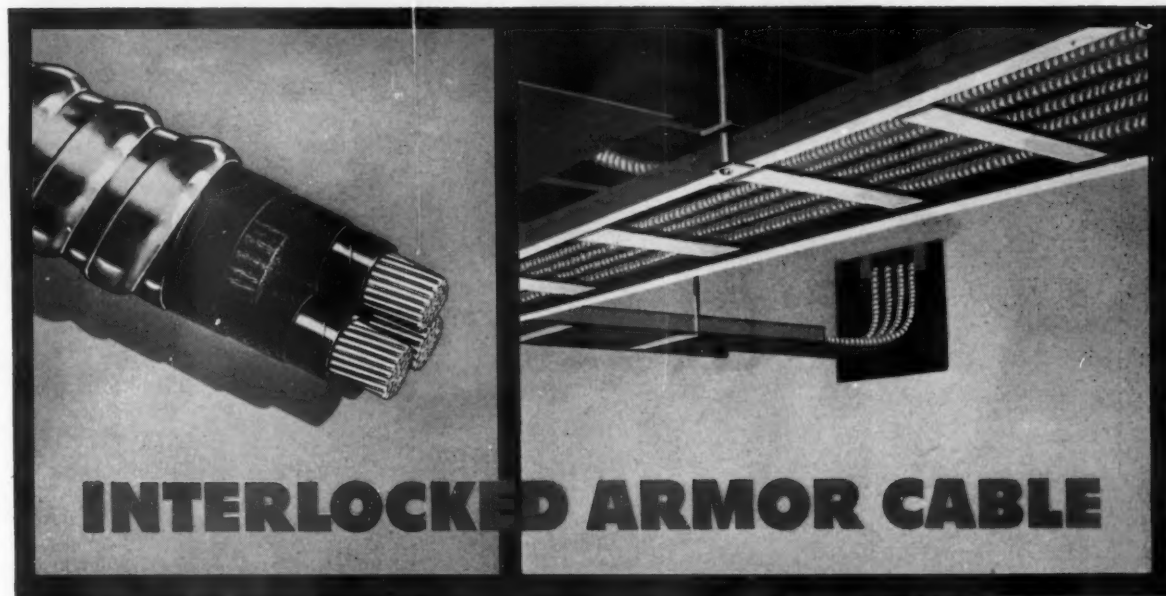
"Secondary conductors, not the primary conductors, are regarded as constituting the service conductors to the building proper in the following cases:

1. Where step-down transformers are located outdoors.





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D P double pole	1202	1222
3 W 3-way	1203	1223
4 W 4-way	1204	1224

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2. Where step-down transformers are located in a separate building from the one served.

3. Where step-down transformers are located in the building served in a transformer vault conforming to the requirements of Sections 4541 to 4548, and under the sole control of the supply company."

Therefore, in the case in question, if this transformer vault which you mention is owned and controlled by the company being served, the service equipment may be located in the primary providing the switch used is capable of being opened under load. If you plan to use a switch which is not capable of interrupting full load, then Section 2389 would require that the switch be interlocked with the circuit breaker on the secondary side of the transformer so the switch cannot be opened when the circuit breaker is closed.—G.R.

## Service Stations

**Q.** I would like a complete explanation as to what is required by the Code for hooking up pumps in service station locations?—G.O.

**A.** This Section 5120 of the Code has come in for a great deal of discussion. The scope of this question is too broad to be discussed in a column of this sort. There has been some discussion of this problem in various magazines.

Mr. B. A. McDonald has written several articles in the *IAEI News Bulletin*. The first of these appear in the September 1954 issue and a second article appears in the January 1955 issue. *Electrical South* in the April 1954 and May 1954 issues carried a series of articles written by myself.—B.Z.S.


## Breathers and Drains

**Q.** Does the Code require breathers and drains on both vertical and horizontal raceways?—G.G.

**A.** Section 5015c5 states that "Where there is probability that water or other condensed vapor may be trapped . . . at any point in the raceway system, approved means shall be provided to prevent accumulation or to permit periodic drainage of such water or condensed vapor".

I believe the intent is clear to require some means to keep all conduit runs, where practical, free from water or condensed vapor accumulation. It is not always possible to do this, as for





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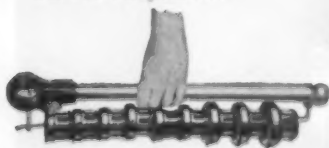
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example in underground runs, conduit lines embedded in masonry, etc.

Each installation should be carefully studied and worked out with the local inspection authority to obtain the optimum efficiency from the system.—B.Z.S.

## **Trol-E-Duct Used As Branch Circuit**

**Q.** Section 2127 of the Code states that receptacles connected to 50-amp branch circuits shall have a 50-amp rating. Do receptacles connected to 50-amp single pole trolley duct require this rating? I have in mind trolley duct as manufactured by the Bulldog Mfg. Co. which has receptacles which can be attached and are rated at 15 amps and can take an ordinary 2-prong plug. If such receptacles are used with the duct can the branch circuit protection be 50 amps or is it limited to 20 amps?—F.D.

**A.** Section 3651 recognizes the use of a busway as a branch circuit of any one of the types described in Article 210. When so used, the rating or setting of the overcurrent device protecting the busway shall determine the ampere rating of the branch circuit and the circuit shall in all respects conform with the requirements of Article 210 applying to branch circuits of that rating.

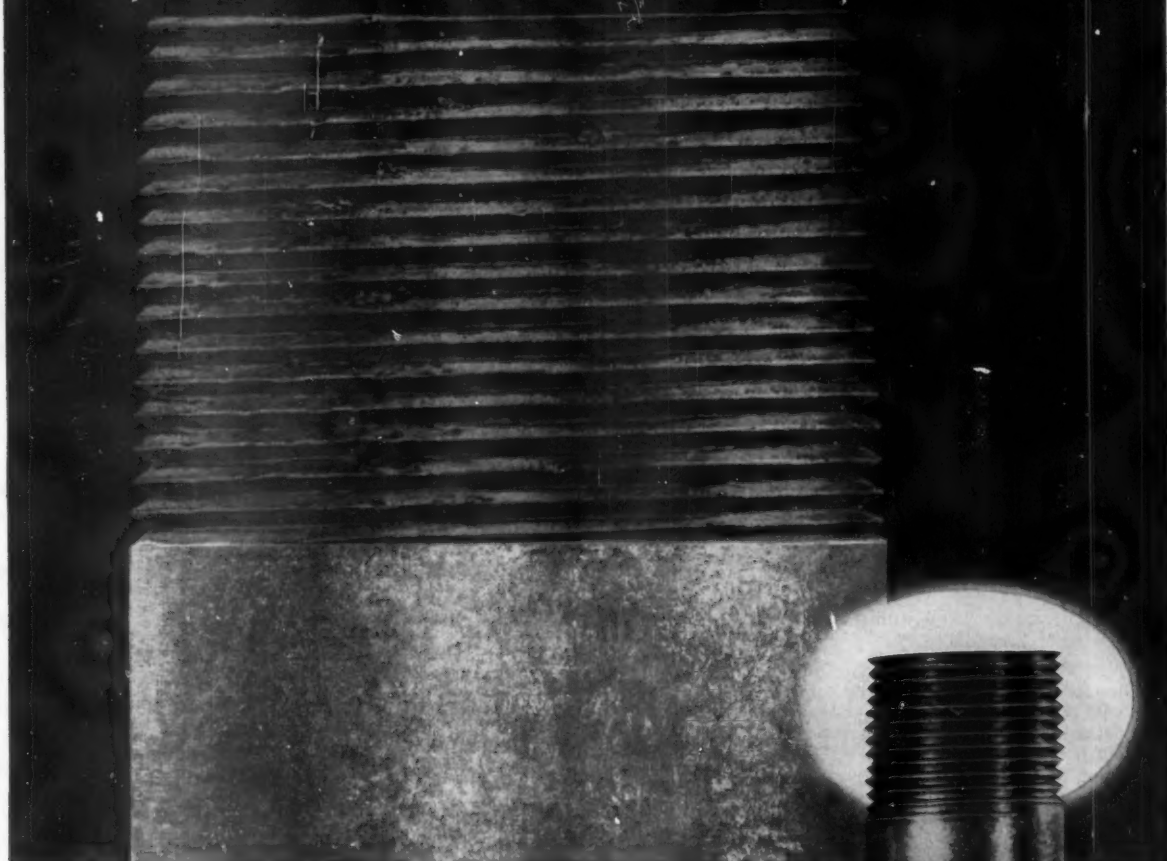
Section 3652 limits the use of busways which are used as branch circuits and which are so designed that loads can be connected at any point to such lengths as will provide that in normal use the circuits will not be overloaded. In general, the length of such run in feet should not exceed three times the ampere rating of the branch circuit.

In accord with these two Code provisions, a 50-amp Trol-E-Duct busway may be used as a 15-, 20-, 30-, or 50-amp branch circuit depending upon the rating of the overcurrent device protecting the busway. When the overcurrent device is 30-amp we have a 30-amp branch circuit and either 20- or 30-amp receptacles may be used as covered by Section 2123b or 2127. If the overcurrent device were 15-amp the receptacle rating would be limited to 15 amps.

In answer to your specific question a 15-amp receptacle connected to a 50-amp Trol-E-Duct, used as a branch circuit, would be recognized by the Code provided the branch circuit overcurrent devices protecting the bus did not exceed 20 amps. I believe this opinion may be verified to some degree by reference to Official Interpretation No. 373 issued June 5, 1951.—B.A.McD.



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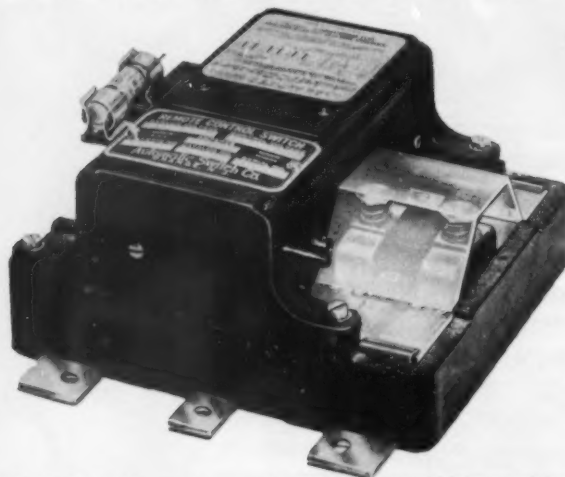
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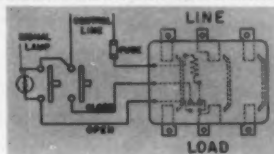
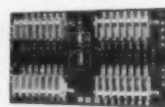
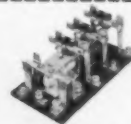


Diagram of Bulletin 920 Remote Control Switch shows pushbutton control, built-in fuse, and signal lamp that requires no extra wiring.



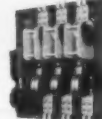
FOR WIDE RANGE OF MULTI-POLE REQUIREMENTS Bulletin 910



FOR SMALL PANEL BOARDS Bulletin 900



FOR HIGH CAPACITY, HEAVY INDUCTIVE LOADS Bulletin 911  
WHEN LOAD REQUIREMENT EXCEEDS BULLETIN 920 CAPACITY Bulletin 910



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## Overcurrent Protection

**Q.** We have a system which uses a 3-wire, 3-phase, 240-volt, delta secondary with one corner grounded. How many overcurrent devices must be used?—A.E.P.

**A.** Section 2371 requires each ungrounded service entrance conductor to have overcurrent protection. You will have in this case two overcurrent devices, one each, respectively in each of the two ungrounded phase wires.

Section 2405 similarly requires an overcurrent device in each ungrounded conductor. This section also refers to Table 28, Chapter 10. This table shows two trip coils or relays, one in each ungrounded conductor. This is also shown in Figure 14 in Chapter 10. —B.Z.S.

## Service Switch Location

**Q.** Is there a maximum or minimum distance that a main switch should be on the load side of the meter in residences and in commercial or industrial establishments? If there is what is the distance?—G.H.T.

**A.** The Code does not specifically state any distance. Section 2351a in the second sentence covers this by requiring the switches (or circuit breakers) to be "... located at a readily accessible point nearest to the entrance of the conductors (service entrance conductors) either inside or outside of the building wall".

The meter location is not of importance from the standpoint of the Code. Therefore the distance from the meter to the switch (or switches) is under no conditions a governing factor.

Since as many as six switches or circuit breakers are permitted by this same Section 2351a, to serve in lieu of a single service disconnecting means, it is evident that a definite distance cannot be given. For example, six 30-amp switches will not occupy the same space as six 600-amp switches. The length of unprotected service entrance conductors is much greater with the installation of the 600-amp switches.—G.R.

## Service for a Large School

**Q.** Is the following service installation correct for a school? The power company is providing a 3-phase, 4-wire, 120/208-volt trans-





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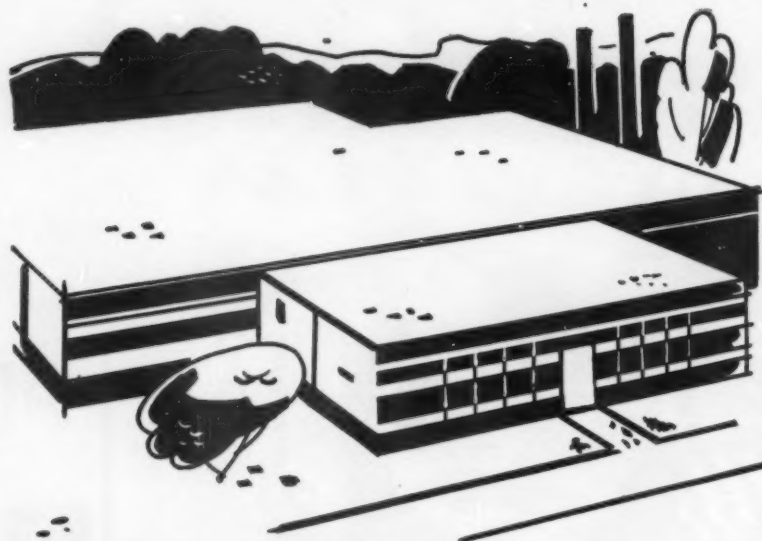
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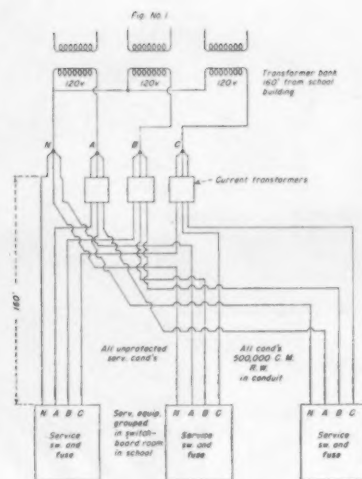
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Should these underground cond's be run in multiple?

former bank on a bipod with C T cabinet. The contractor will run three conduits underground a distance of 160 ft, each conduit containing four 500 MCM, type RW conductors, to a central switchboard room. Each set of conduits will terminate in a fused switch in the switchboard room, but these conductors will not be tied together except at the transformer's secondary. There will be no secondary protection of these conductors at the transformer bank end.—K.D.B.

**A.** Section 2301 of the Code provides that a building shall be supplied through only one set of service conductors except:

- a—For service drop conductors as covered by Section 2321.
- b—Buildings of multiple-occupancy (Sections 2351-b and 2371-a-4.)
- c—Where additional services are required for different classes of use.

The definition of Service Conductors, Article 100 is as follows: "That portion of the supply conductors which extends from the street main or duct or from transformers to the service equipment of the premises supplied.

It appears evident from the foregoing that the exception to the general provision as covered by "a" applies only to overhead conductors and not underground conductors. (See definition of Service Drop). It also follows that the exception for multiple occupancy buildings does not apply to the single occupancy building in question. Exception "c" would apply to an underground service provided the occasion required different classes of services.

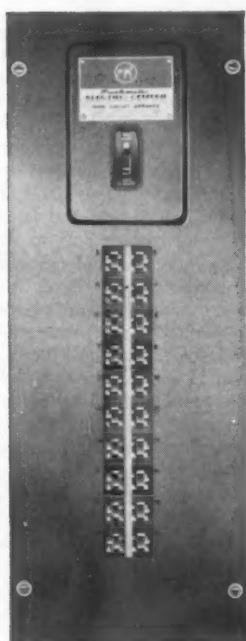
Since the service installation proposed for use by the Utility consists of three individual sets of service conductors, with no exceptions recognized, it appears that there is a viola-





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tion of Section 2301 which limits the service to one set of service conductors.

While this opinion is based on a literal reading of the rules involved, it has often occurred to me that the exceptions of Section 2321 should not be restricted to service-drop conductors. In the case of underground services, which are not included under the definition of a service-drop, the occasion for separate sets of service conductors for serving fire pumps, emergency lighting, capacity requirements, etc., are frequent and deserve the same consideration as now extended the service drop, and it is my impression that some inspection authorities have interpreted these Code provisions accordingly. If such was the intent, it appears to me that the proposed installation would be justified in line with the exception for "capacity requirements" as covered by Section 2321.

In accord with a literal reading of the Code, it appears that the three sets of service conductors should be run in multiple and terminate in a common bus from which taps are run to each of the three sets of service equipment. This method involves caution since the multiple conductors must be the same length and the terminal connections so arranged as to insure equal division of the total current between all conductors involved. Under the particular conditions outlined, I am unable to point out any distinction in hazard between the use of either method. In fact I am inclined to believe that the proposed method, which eliminates the use of multiple conductors and several points of terminal connections or splices would be the most effective way to serve the building in question. A copy of this personal reaction is being forwarded to the chairman of Panel No. 3, National Electrical Code Committee, with the thought that the points I have raised are worthy of consideration for clarification.—B.A.McD.

## Multiple-Services

**Q.** The local utility company, out of technical considerations, has limited the 1-phase load per building on each phase of their 4160/2400-volt 3-phase line to 100 kva. This frequently necessitates two phases and a neutral, two separate 1-phase transformers with separate secondary services (not in parallel) and two sets of current transformers with but one totalizing meter. The transformer vault in this case is under the sole control of the supply company.

With reference to par. 2386, do the two separate secondaries from the vault constitute two services and may



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# ONE HAND CONVENIENCE

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**Ramset**  
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SPEEDS WORK ON  
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for light, medium, heavy duty
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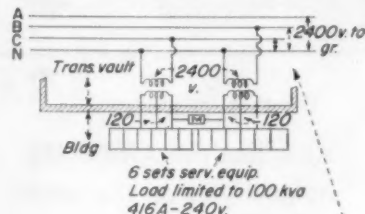
**Ramset Fasteners, INC.**  
RAMSET DIVISION—OLIN MATHIESON CHEMICAL CORPORATION

12105 BERE A ROAD • • • CLEVELAND 11, OHIO



up to six switches be placed on each service or must the total for both services be limited to six switches (par. 2351).—J.M.N.

**A.** In order to clarify the problem, I have shown by the sketch the conditions involved. It appears to me



Vault under sole  
control of supply Co.

that we have two sets of service conductors feeding the building, through two separate single phase transformers. I do not believe that the use of the totalizing meter alters the rules involved since the provisions of Section 2375-e, covering meters, appear to be satisfied. I do believe, however, that the question of the use of totalizing meters should be covered by the Code since in many cases they record the power delivered through services that are widely separated. Since we apparently have two sets of service conductors, it follows that each set could have as many as six service disconnects and fuses or six circuit breakers.

Section 2301 however limits in general the number of services to a building to one. There are several exceptions to this rule and it appears to me that Section 2321-c would in some cases warrant the two sets of service conductors. This Code provision permits more than one service-drop to a building when capacity requirements make multiple services desirable. While this provision applies only to service-drop conductors, it appears inconsistent to me if it was not intended to cover the case in question.

While I am not familiar with local conditions, it appears to me that the question of balancing the single phase load would be better satisfied if one 3-phase-4 wire service was installed. I realize that other factors may be involved since the power voltage would be reduced to 208 volts. If this is a factor to be considered, it could be satisfied by the use of a transformer. It also appears to me that the provisions of the local utility merely limits the single phase load to 100 kva per phase and unless there was a very good reason, I would be inclined to ask that the 3-phase, 4 wire 120-208 volt service be installed. I do not believe we should be using a questionable exception to a fundamental rule unless the conditions involved fully warrant the exception.—B.A.McD.



MODERN "TOOLS" FOR MODERN LIGHTING

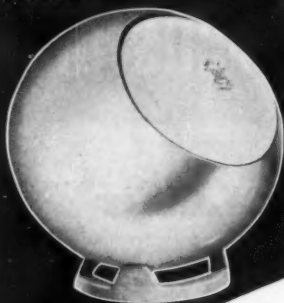
# amplex Swivelite

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Fixtures...  
Specified by  
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Won't tip over—easy to  
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Take a tip from professional lighting experts—use Amplex Swivelite Fixtures where the lighting problem requires beauty and concentrated light for attention-getting effects. These are without question the finest, most adaptable "working tools" for achieving up-to-date lighting with real *selling power*. And for more striking and colorful light, specify Amplex Spots, Floods and Colorbeam Reflector Lamps, designed especially for Amplex Swivelite fixtures. Write for new catalog describing the Swivelite *big four* exclusive features that produce effect, efficiency, economy.



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for shorter runs of copper...  
reduced line losses...  
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*get the right voltage  
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Wagner Dry-Type Transformers give dependable power distribution right at the load...close to your portable tools, machines or lighting system. This means a big savings to you in terms of shorter runs of copper, reduced line losses and lower installation expenses. Not only that, Wagner Dry-Type Transformers are compact, light in weight and safe to use—even in the presence of fire hazards.

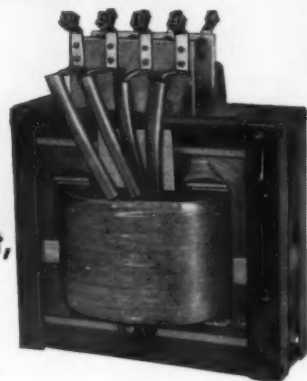
The new 150° rise, totally-enclosed dry-type transformer with silicone insulation, is designed especially for use where ventilated transformers are impractical. When you install these transformers, fireproof vaults and other protective enclosures are unnecessary. Core and coil is protected from lint, moisture, dust and other contaminating materials by totally-enclosed sheet steel cases...and this kind of protection reduces maintenance to almost nothing. They can be installed outdoors, because their construction is completely weatherproof.

The 150° rise transformer is standard in ratings 3 through 10 kva and is also available through 50 kva. The 55° rise model is standard in 1, 1½ and 2 kva and the 80° rise transformer is standard in ratings 15 through 100 kva.



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**Form W**

Core and Coil  
permits compact,  
lightweight  
transformers...



The heart of each Wagner Dry-Type Transformer is the famous Wagner Form W Core and Coil assembly. Core is of cold-rolled oriented grain transformer steel. The Form W design permits less weight per kva and small size cases for space saving installation.

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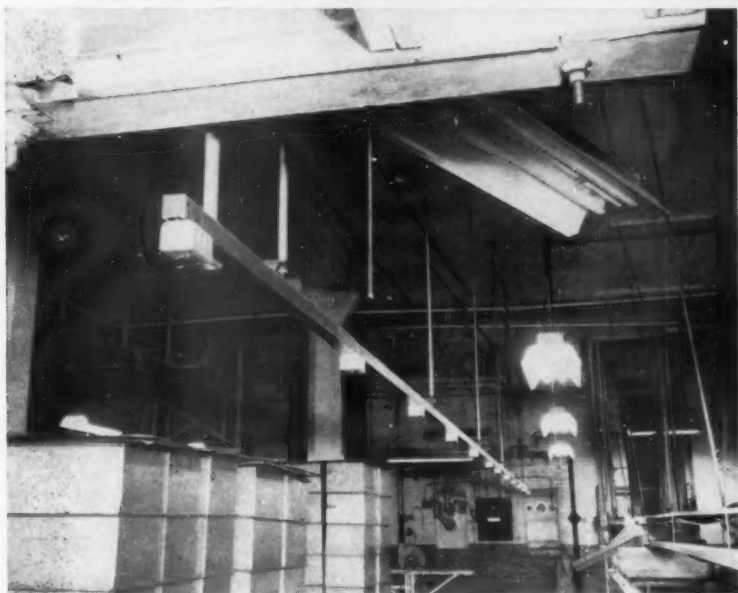
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ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC



# Practical Methods



**ELEVATED OUTLETS** parallel cookie conveyor lines at Manchester Biscuit Company in Fargo, N. D. Grounded, 3-wire, 20-amp, twist-type receptacles serve take-off conveyors, cross-pack machines, bag-stitchers and case stitchers. Twelve outlets are mounted 6 ft, 6 in. above floor on 40-ft run of continuous channel framing member which acts as support and conductor raceway. A duplex, 2-wire, grounded receptacle at each end of channel serves vacuum cleaner for keeping areas clean. All flexible cords are out of way of workers. Installation by Dakota Electric Construction Company, Fargo.

## Three-Phase Motors Run On Single-Phase Circuits

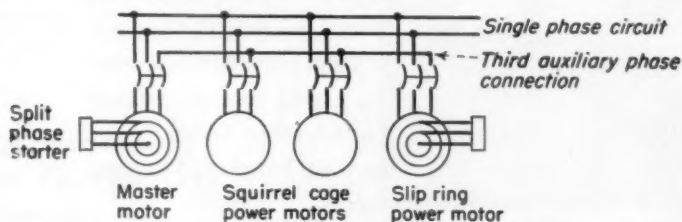
INDUSTRIAL

Sometimes a small industrial plant, having a load too small to justify the local utility company carrying a 3-phase line into the premises, is urged to install single-phase motors until such time as the overall load increases. And, on the other side of the fence, we sometimes find an industrial operator, with a supply of 3-phase motors on hand, moving into a new building served only by single-phase circuits. Both conditions create a problem but, by adapting a wiring sys-

tem suggested by Westinghouse engineers, a single-phase source of supply can provide the inherent characteristics for 3-phase motor operation and, by following their suggestions, the above problems can be solved.

In this system, a 3-phase master motor is installed in addition to the 3-phase power motors; the master motor being either a standard squirrel-cage or wound-rotor type unit. The size of this master motor should be at least equal to 10% or 15% of the total system load, although a larger motor has better results.

As indicated in the accompanying diagram, both the master motor and the power motors are connected with



**AUXILIARY CONDUCTOR** connects third phase lead of master motor with similar leads of the power motors, thereby providing power motors with characteristics approximately equal to those obtained on a 3-phase circuit.

2-phase leads going to the conductors of the single-phase circuit and the third phase lead of each motor connected to an auxiliary third leg.

The master motor's primary function is to furnish auxiliary current to the third phase lead of the power motors so, as a general rule, the master motor should be run unloaded or, at most, with a loading of not more than 25% of its rated capacity.

The master motor is started up with special starters, similar to those used for the starting of split-phase induction motors, then the power motors may be started up, one after the other in progression, just like regular 3-phase motors with almost full 3-phase starting torque.

It is apparent that, with this connection, the working motors are provided with circuit characteristics almost like those on a 3-phase line although, if all motors were loaded to the same degree in relation to their rated capacities, no current would flow in the third-phase conductor. Furthermore, a power motor would become a master motor as soon as its load was removed and, if the master motor is not capable of completely fulfilling its purpose, an unloaded power motor would become overloaded attempting to carry part of the master motor's load.

By operating motors as 3-phase units, a gain in efficiency is experienced, but this gain is offset by losses of the master motor. Therefore the overload efficiency of the entire system is only equal to that of a single-phase installation, and the output of the power motors so connected is only 75% or 80% of the 3-phase ratings. For these reasons, the system is not recommended, except to solve the problems initially cited.

## Special Coffers Illuminate Arcade

LIGHTING

When the Union Trust Building of Pittsburgh was recently modernized, the central arcade was resurfaced with marble and the original high-ceilinged corridor had its height greatly reduced by the introduction of an intermediate floor at mezzanine level. The installation of this auxiliary floor thereby rendered the old lighting system useless for ground-level illumination, so the Frame Electric Company was





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**CUSTOM-MADE FIXTURES** are recessed into the ceiling of this marble-walled bank arcade, providing illumination levels up to 33-fc. Panels are of corrugated plastic; each fixture contains eight 40-watt cool-white lamps, while multiple switching permits a 3-level lighting selection.

asked to submit recommendations concerning a new lighting plan.

The objectives of the new plan were to create a modern, attractive, bright, clean and cheerful appearance without disturbing the dignified decor of a banking institution. Working closely with the owners, architects and the Frink Corporation, Frame met these objectives and installed a system that provides intensities up to 33 foot-candles.

As installed, the lighting plan consists of seven 8-by-4-ft custom-made recessed fixtures; each unit containing eight 4-ft 40-watt T-12 cool-white bi-pin fluorescent lamps. Fixtures consist of 18-gauge steel housings, aluminum T-bar framing members, and  $\frac{1}{2}$ -in. corrugated Plexiglas and acrylic-plastic panels; the housing finished in baked white enamel, and the plastic corrugations assuming a  $\frac{1}{2}$ -in. wave form. Units are spaced at intervals of 8 ft center-to-center.

Circuiting permits lamps to be operated in three groups; thereby creating 3-level lighting provisions for dark or bright days, rush-hour or night-time use. By this means, illumination can be selected to conform with the general nature and tempo of the hour and outdoor weather, and comments from pedestrians visiting the arcade have been highly satisfactory.

**Use Tag-Board  
For Tool Control**

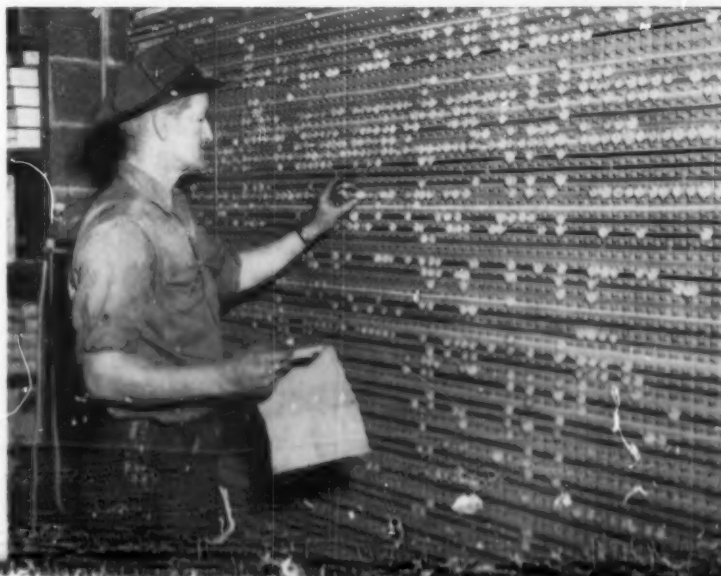
apolis, Ind., tells the tool dispatcher what tools are on which specific jobs at any given time. There is no need to go through a sheaf of records to find the information he wants. He merely checks the tags hanging on L-shaped hooks mounted on the board.

There are more than 5,000 hooks on the board with room for many more. Hooks are arranged in 65 horizontal rows (left to right). Each row represents a job or construction project noted on a card mounted on a holder at the left side of the board. Each horizontal row has 84 hooks, one hook for each of some 84 different tool and

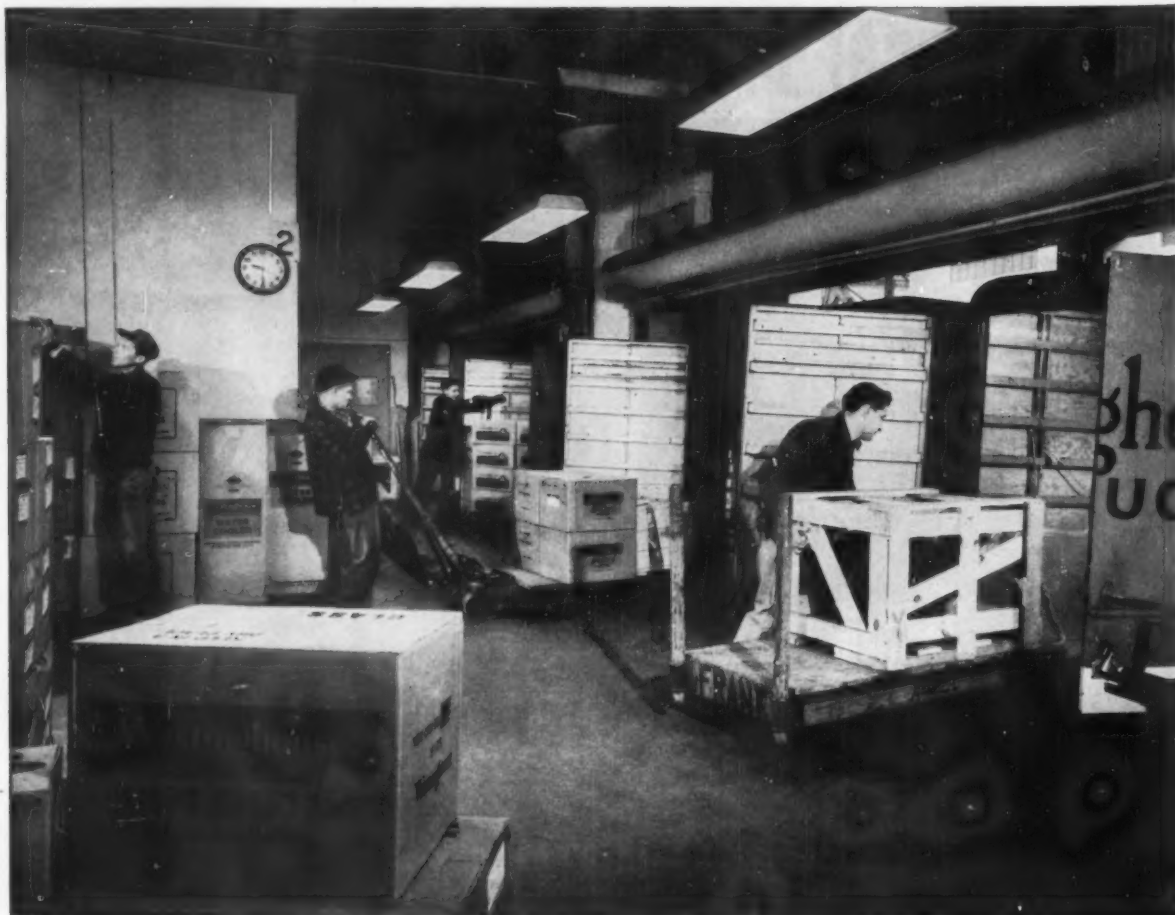
equipment items that might be needed in the field. Above each vertical (top to bottom) column of hooks is the name of the tool or equipment item. These range from power benders and drill presses down to ladders, oil cans, punches and chairs.

An ordinary cardboard (metal-ringed) key-tag is placed on the proper hook when a tool goes out to a job. The back of the tag has the name of the tool; the front of the tag has the identifying number stamped on the tool. Suppose a  $\frac{1}{2}$ -in. electric drill No. 28 were sent to Job No. 1234, the Doe Mfg. Co. Drill tag 28 would be placed on the hook in the " $\frac{1}{2}$ -in. electric drill" column opposite Job No. 1234 (say, fourth row). If there were five drills of this type on this specific job, the hook would have five tags, each with a different identifying tool number. The same procedure applies to all tool items sent to the field. When tools are returned to the shop, they are checked in carefully and the tag removed from the board. Empty hooks indicate there are no tools of that category on the job site.

If a request for one or more specific tools comes in from the field, the tool dispatcher checks the shop inventory. If none are available, he can quickly check the tool control board and note on which job several tools of that type are now located. Through a telephone or field call to this job, he may succeed in having the items released and re-assigned to the project needing the tools most. If projects are too distant from headquarters, it might be more economical to simply move tools from







## **FACT: You Now Get Same-Day Delivery on 13,584 Electrical Items from Wesco**

Now, from one dependable local source, WESCO ships over 85% of all orders the day they are received. This fact makes your jobs easier—and it also means you don't have to stock normal electrical maintenance and repair items.

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country's finest electrical products is WESCO's ability to assemble specially trained personnel to solve any on-the-job problem you may have.

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# **WESTINGHOUSE ELECTRIC SUPPLY COMPANY**





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## Use Tag-Board For Tool Control

### MANAGEMENT

A glance at an 8-ft sq,  $\frac{1}{2}$ -in., plywood board on a partition in the tool room at Hatfield Electric Company, Indian-

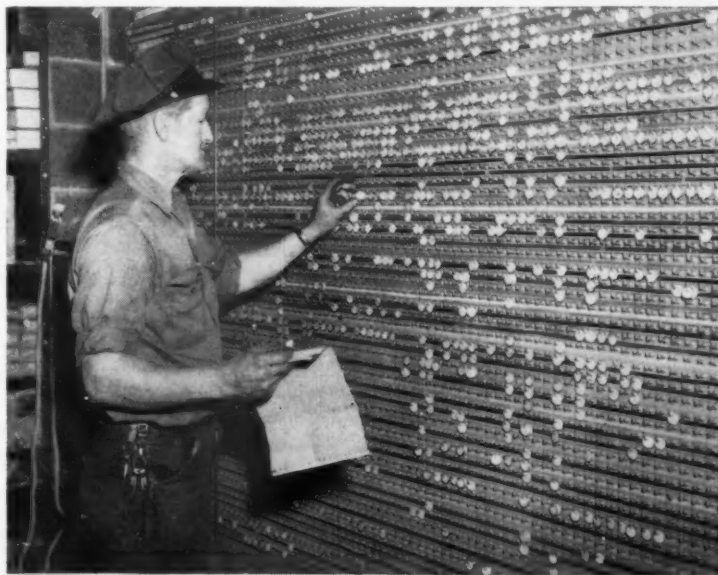
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**DISPATCHER ADDS** or removes tags (conventional cardboard key tags) as tools go out and return from the field. Each tag has name of tool on back and identifying tool number on face. Board has more than 5,000 hooks covering some 84 individual items (columns) and 65 projects (horizontal rows).





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Floor Box**



**Adjustable  
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Once installed, wire cannot come in contact with exposed receptacle terminal screws inside box.



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High quality staples or cable clips can be ordered in cartons, kegs or barrels.



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Adjustable Floor Boxes  
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Junction Boxes . . . Nozzles  
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## **Fullman Manufacturing Co.**

1209-1215 JEFFERSON STREET  
LATROBE, PA.

one job to another without first coming into the shop. When this is done, the dispatcher is careful to immediately shift the tags on the tool control board to accurately indicate existing tool assignments.

With so many hooks on a board of this size, it might seem difficult to get a tag on the proper hook—in the right tool column and opposite the right job number and name. Inadvertently placing it up or down one row might result in inaccurate indications of tool dispersement. Actually, it's a fairly simple chore. Two features of the board prevent this mistake from being made. Each horizontal row of hooks is clearly outlined by narrow strips of colored plastic tape running across the entire length of the board and each column is separated by score lines.

Hatfield's tag-board is a simple method of keeping track of more than a quarter million dollars in tools. Their inventory includes such expensive items as more than 100 4-in. hydraulic benders, some 60 metal cutting band saws, about 40 large pipe threading machines and 30 200-amp electric welders. These, in addition to hundreds of smaller hand and power tools. Unless a close tab is kept on these items, loss, misplacement or misassignment could result in a substantial monetary loss in equipment and installation efficiency. This is particularly true when tools are scattered over some 50 jobs with about 500 mechanics involved.

Actually, the tool control board supplements a standard card file record maintained by the tool dispatcher. There is a 3-in. by 5-in. file card for each tool item. On each is the name of the tool and the tool number; also, columns to indicate if the tool is "in" or "out". If out, there is space to indicate the job name and job number; also a place for "remarks" such as tool condition, repair record and other pertinent information.

One factor contributing to the installation efficiency on Hatfield projects is the mandatory check given every tool as it comes into the shop. A thorough inspection is made of each item to determine operating condition. Worn parts are replaced, cutting edges sharpened, damage repaired and the tool placed in first-class condition before it goes into "stock".

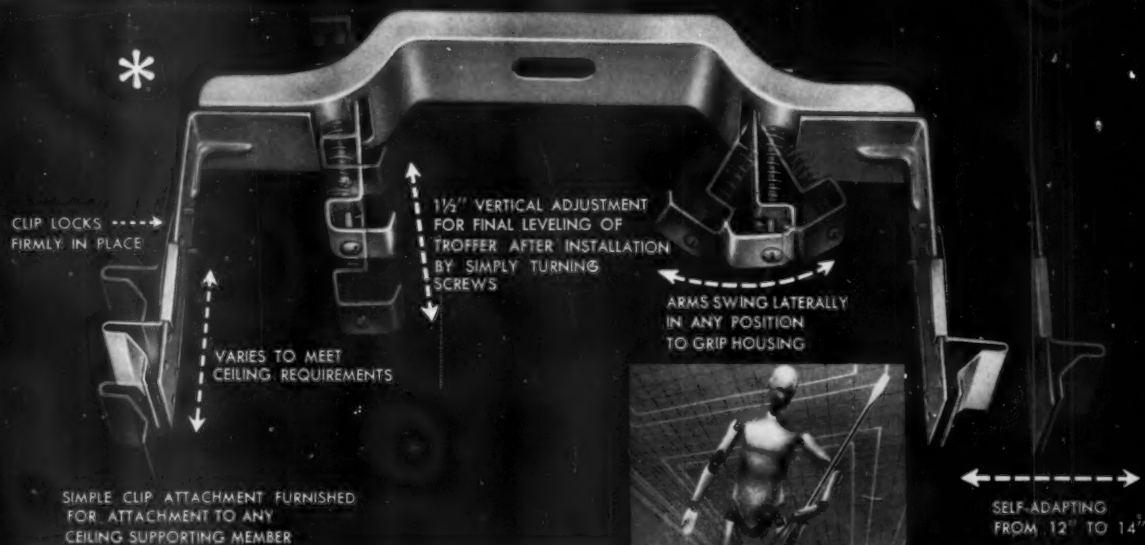
## **Savings and Safety of TV Transmission Line Boosted by Arc Welding**

### **LINE CONSTRUCTION**

Whenever a TV program is blacked-out due to a failure of equipment, the television station involved



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**Maximum adjustability wherever you need it with no exact positioning required.** That's it in a nutshell . . . why the new Smithcraft Troffer is installed so **quickly and economically** with the new Smithcraft Yoke-Aligner Hanger Assembly. **And you need only a screwdriver during the entire installation for final levelling.** The sturdy Yoke-Aligner Hanger Assembly firmly supports the troffer and prevents toeing-in or other distortion, yet through its built-in adjustable features provides maximum adaptability and flexibility to meet varying ceiling conditions. The Hanger Assembly comes ready for attachment to the ceiling construction into which the troffer is to be installed. A simple easy-to-handle clip locks the Yoke-Aligner Hanger Assembly to the ceiling members. **These new Smithcraft Troffer features save hours and dollars in installation time.**



Send today for the new 36-page Smithcraft Architectural Troffer Book giving complete details on both 12" and 24" Smithcraft Troffers. Gives complete installation details using the Yoke-Aligner Hanger Assembly. Also shows the new Smithcraft Troffer-in-Plaster Frame method . . . another Smithcraft time and money saver for troffer installations in plaster ceilings.

## Smithcraft

LIGHTING DIVISION, CHELSEA 50, MASSACHUSETTS

\* Patent #2,597,875;  
other patents pending

Troffer housing hooks on and swings into position. Reflector is held by thumb screw while four captive screws are tightened.

Final leveling is from below after installation by turning screws in Aligner Hangers.

Door frame containing shielding is simply hooked on. Opens or closes by fingertip pressure upwards. In louvered troffers, louvers are hinged on both sides on Smithcraft's patented Duo-Cam Hangers. May be removed without tools or loose parts.



engineers of leading  
industries are specifying



Courtesy Newark Evening News  
South front of beautiful, ultra-modern office  
section of new Ford plant at Mahwah, N. J.

## Marcus TRANSFORMERS

Marcus Transformers installed for  
lighting distribution in new Ford  
plants near San Jose, California,  
Louisville, Kentucky, and Mah-  
wah, New Jersey as part of the  
Ford Motor Company's huge  
coast-to-coast multimillion dollar  
expansion program.



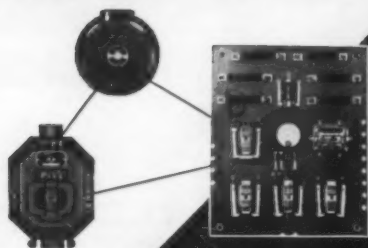
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coded and non-code types

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fire alarm system. Therefore, when ordering Interior Fire Alarm Systems, be  
sure to specify equipment (control panels, stations, and fire alarm bells)  
produced by Signal Engineering & Manufacturing Co., the originators  
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Both coded and non-code types are available in various arrange-  
ments depending on type of building or establishment. Although  
Interior Fire Alarm Systems are intended primarily for warning  
occupants of a building, they can be connected into a munic-  
ipal system.

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representative,  
in principal cities  
are available to  
assist in specifications.

Write for Bulletin FA-3

*Wheelock*

**FIRE ALARM  
SIGNAL**  
ENGINEERING & MFG. CO.  
1110 WASHINGTON, NEW JERSEY



**TELEVISION** transmitter building and  
antenna tower are connected by dual  
coaxial transmission lines supported by  
specially-designed steel pole and angle  
messenger assembly. Installation saved  
\$1200 compared to conventional line  
construction methods.



**SUPPORTING POLES** were set in sleeves  
embedded in concrete base piers. Poles  
were capped by sections of 6-in. channel,  
to which horizontal angles were attached.  
All connections (sleeves, poles, channels  
and angles) were made by arc welding.

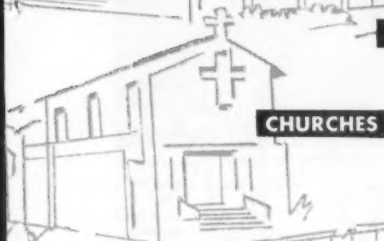
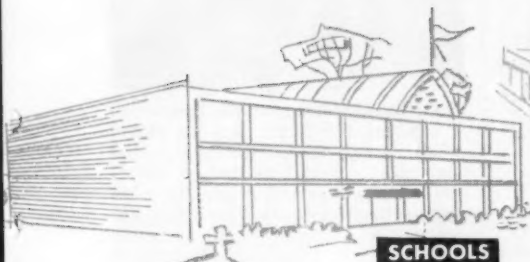
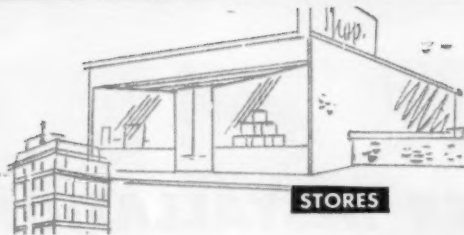
in the incident generally has to record  
that fact by entering a few bright red  
numerals in their profit and loss  
statement. As a result, program contin-  
uity becomes the "sacred cow" at  
all stations, and equipment protection  
becomes an engineering and mainte-  
nance "must".

Therefore, when NBC's Cleveland  
Station WNBK-TV planned a 400-  
ft coaxial transmission line, connect-  
ing their Parma transmitter with a  
new 900 ft antenna tower, much  
thought was given to the possibility of  
damage occurring to the line by ice  
falling from the antenna above it.

Departing from normal line-con-  
struction methods, NBC's supervising  
engineer Fred Everett planned a  
series of concrete piers, steel pipe  
poles and angle iron messengers—all  
put together by arc welding. In actual  
construction, a pipe sleeve was placed

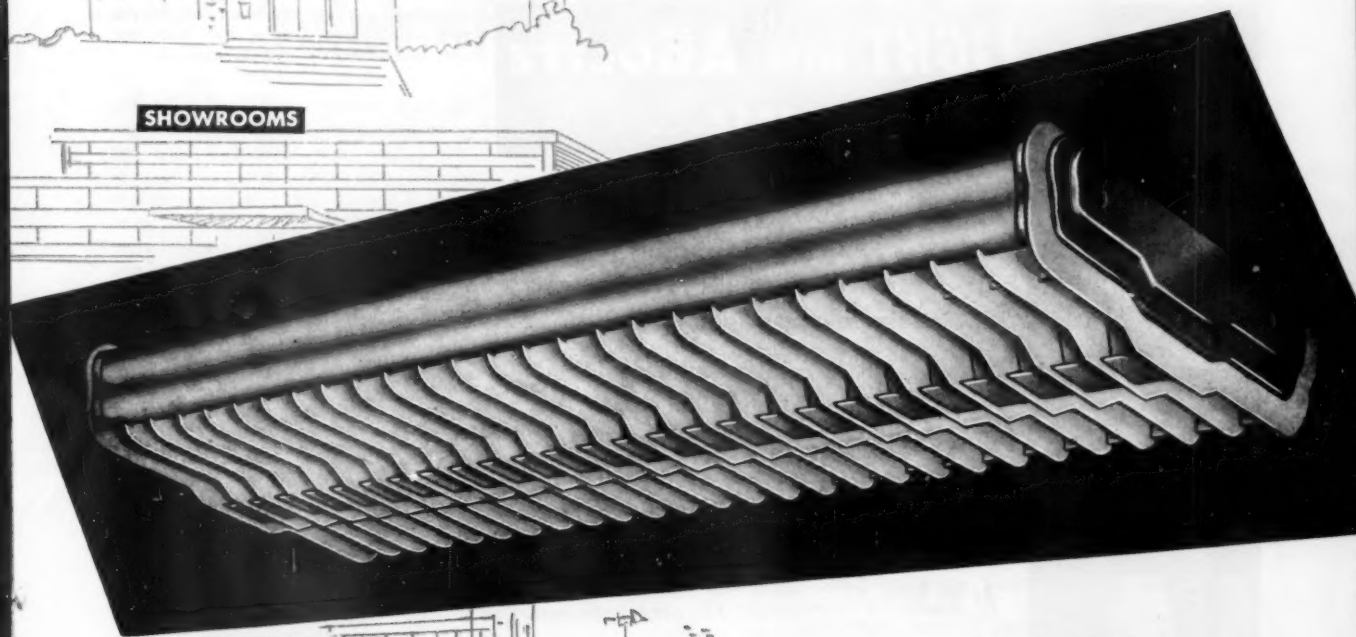


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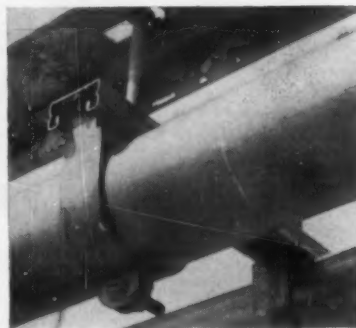
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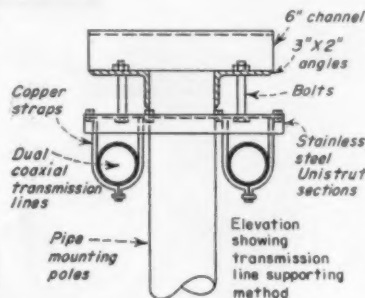
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**STAINLESS STEEL** Unistrut sections served as separation mediums between copper coaxial cable clamps below, and steel bolts above. Bolts pass through slotted holes in the horizontal angles; the slots permitting differential expansion of the components.



**PROTECTION** against the possibility of ice falling from the antenna above is provided for the transmission lines by the two 3-by-2-in. angle-iron runs that support and shield the coaxial lead-ins.

in each concrete pier prior to the pour and, after the concrete had set, the poles were telescoped into the sleeves and welded for positive support. Capping each pole was a section of 6-in. channel, likewise welded, serving as a bearing for two parallel runs of 3-by-2-by- $\frac{1}{8}$ -in. angle iron sections, mounted flange-down as indicated in the accompanying diagram. Then, at 5-ft intervals, additional sections of 6-in. channel were welded between the angles to eliminate twist and rack from the completed messenger structure.

The twin coaxial transmission lines were then hung directly beneath the angle runs, which served as linear shields against possible falling ice. Support of the transmission line was by means of copper clamps which, in turn, were secured by stainless steel Unistrut sections attached to the angles by steel bolts. The bolts passed through slotted holes in the angles to permit differential expansion between the steel and the copper components, while the stainless steel separators and spacers served to minimize corrosion due to electrolytic action.

In fabricating the structure, chan-



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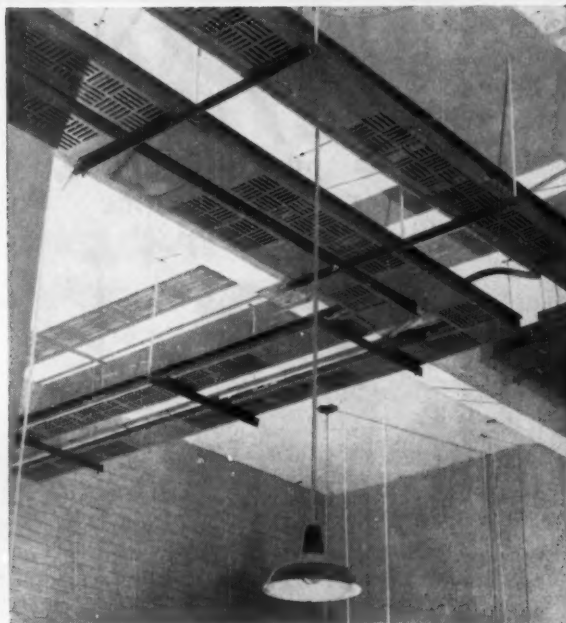
Lighting

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**HINGED POLES CREATED BY REVERE**

**HINGED AND RIGID FLOODLIGHT POLES**

nels and angles were welded so that the assembly initially assumed a slight upward bow between supporting poles. these levelled out perfectly flat when the horizontal runs were finally welded into position and the coaxial cables were suspended beneath them.

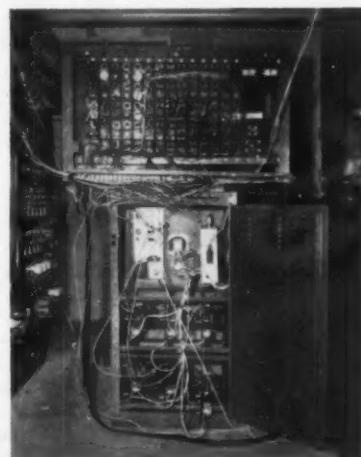
In addition to fast construction and protection for the transmission line, this installation resulted in a sizable saving, for the estimated cost of standard piers and messengers approximated \$1700, whereas the actual cost of punched and delivered angle irons and other components was only \$500—a resulting saving of \$1200. This method, submitted to The James F. Lincoln Arc Welding Foundation for consideration in their recent non-industrial welding competition, also resulted in a very acceptable cash award for engineer Everett.

## Audio System Speeds Elevator Service

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Operatorless elevators provide an efficient, low cost means of vertical transportation in large commercial buildings. Regulated by a computer mechanism which adjusts scheduling to conform with changing patterns of up and down traffic, they completely eliminate the need for elevator operators and starters. Since this represents a saving of from \$5,000 to \$7,000 per elevator annually, they have been enthusiastically received by building owners.

A major problem in the use of oper-



**BRAIN** of phantom voice system is a complex network of relays and electronic timers (top) which actuate any of the six messages stored on tape with separate drive units and pick ups (bottom). Common amplifier (center) relays message to speakers concealed in elevator car ceilings.

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atorless elevators have been that the uninitiated or unattentive passenger often neglects to push the button to select his floor or to get off when the car arrives at his destination. These, and other similar conditions deriving from passenger omissions or errors have now been remedied with introduction of an automatic sound system for use with this equipment. This new feature, developed by the Elevator Division of Westinghouse Electric Corp., delivers any of six recorded messages appropriate to the particular situation, thus instructing passengers as to what action is necessary to continue operation of the elevator. For example, if a passenger enters the car and fails to press a button for his floor, a voice from the speaker concealed in the ceiling says, "Press your floor button, please." This message is then repeated a short time later to make certain car occupants realize they are their own operator.

Although any six messages may be used, Westinghouse has developed a set which they feel will best meet the requirements of operatorless elevators. As the doors open, waiting passengers are informed as to whether the car is going up or down. If the doors are blocked for more than three seconds, the Voice asks, "Release the doors, please". Two other messages instruct passengers to summon the engineer if a protective device stops the elevator or to release manual emergency button if condition is passed.

In addition, there is a message unit which delivers a different message at each floor. This can be used to announce floor number, to describe merchandise sold at each level of a department store, or to designate special floors in hotels and hospitals where transients compose a large percentage of the passengers.

The brain of the "Phantom Voice" audio system is a selector control cabinet consisting of relays and electronic timers which automatically react to the specified condition of the elevator car, actuating the appropriate tape driving unit at the bottom of the assembly. The magnetic heads on the tape driving units pick up the message from the tape and deliver it to a common amplifier where it is relayed to a speaker in the ceiling of the elevator car which originated the action. When the passengers take the action required by the message, a pulse is sent out to the selector panel which opens the circuit and discontinues the message.

The first installation of the Phantom Voice system is now in operation at the National Distillers Building in New York City. It is expected that its efficiency and economy will bring it wide acceptance in large buildings.

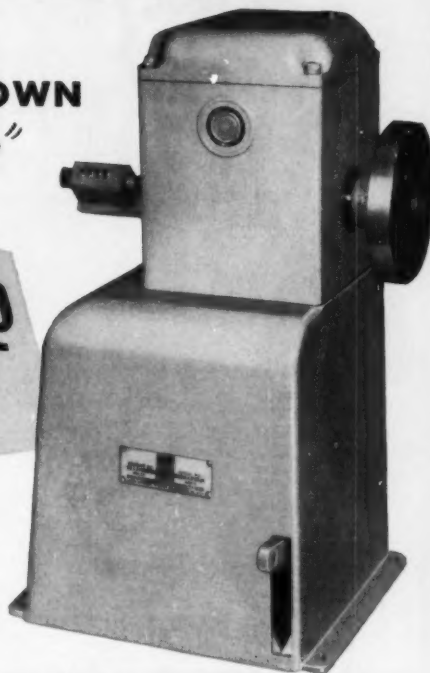
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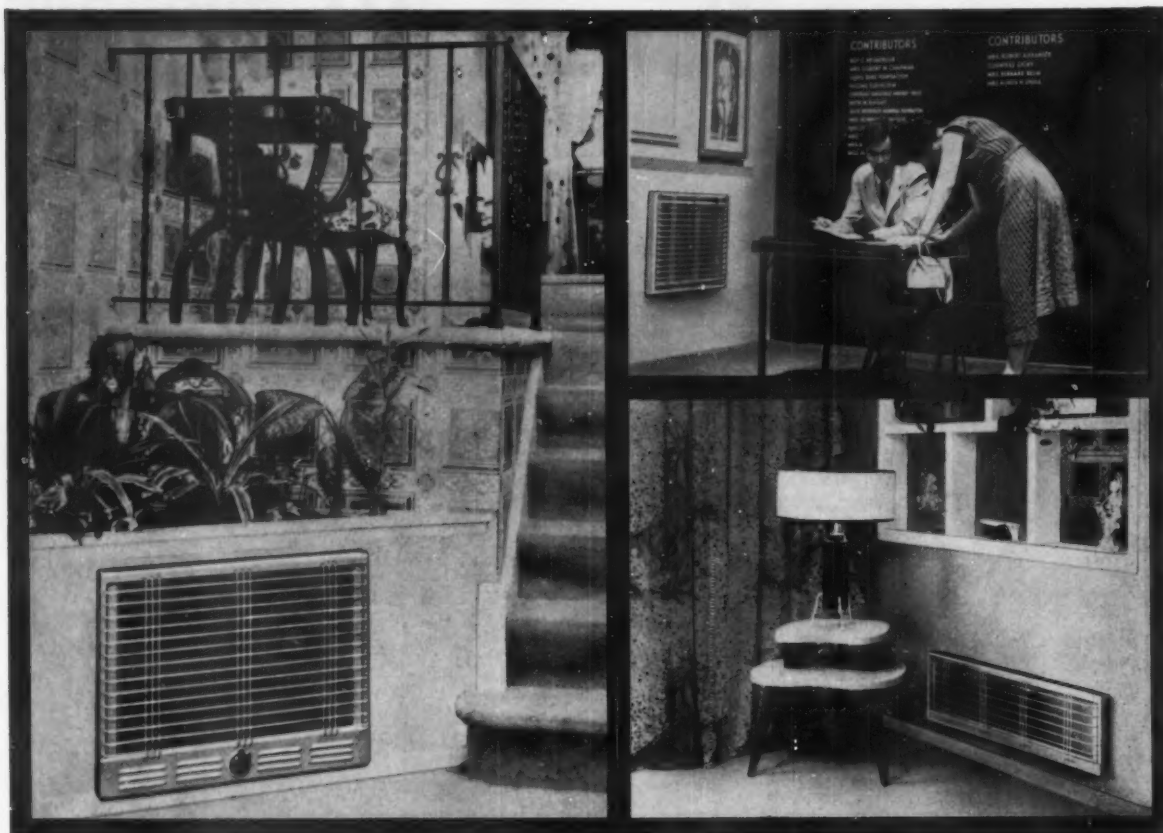
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Installation photographs courtesy of Berko Electric Manufacturing Corp.

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panel distribute the current *evenly* over its entire length and breadth. This provides completely uniform heat radiation.

### Efficient

PYREX Radiant Panels radiate about double the heat of a metal-finish radiator at the same operating temperature. This high degree of efficiency helps bring the cost of electric heat within reach of more homeowners. Also, there is little initial surge of current when these panels are turned on—another point of economy.

The coated side of the panel itself acts as a heat reflector. With the addition of a metal reflector, as much as 80% of the input energy is available as heat radiation from the panel's uncoated side.

At 400°F. over 75% of the panel's heat energy is emitted in wave lengths of four microns and longer. This energy provides instant warmth and comfort.

### Customer benefits

PYREX panels provide clean, draftless heat and the panels themselves are easy to wipe clean. Free dust particles will not adhere to or carbonize on them. In-the-wall installation leaves completely free floor space and installation is easy. There's space saved, too, because there is no heating room. Every room is individually thermostatically controlled. The glass is high in physical strength. It's safe and durable.

For additional technical information on PYREX Radiant Panels, write, wire or phone.



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# In The News

## Impressive Lighting Progress Reviewed by I.E.S. at 47th National Technical Conference

Continuing progress in all branches of the lighting industry was forcefully emphasized during the week of September 12th when approximately a thousand delegates from the United States, Canada and Europe convened at Cleveland for the 47th National Technical Conference of the Illuminating Engineering Society. Highlights of the meeting included addresses by outgoing president Duncan Jones, Curtis Lighting of Canada, and incoming president R. F. Hartenstein, Ohio Edison Company; an impressive review of last year's lighting achievements, by Eugene Beggs of Westinghouse; presentation of the I.E.S. Gold Medal to J. L. Stair of Curtis Lighting; presentation of 12 Fellow Memberships in recognition of outstanding contributions to the lighting industry; the final judging of ten regional winners in the Society's annual nationwide lighting competition, plus 35 technical papers in 11 sessions devoted to developments in light sources, applications, calculations and research, as well as to progress in the fields of residential, architectural, street and day-lighting.

In his opening report, president Jones stressed the importance of continuous, intensive research and techni-

cal perfection in the interest of maintaining a professional engineering atmosphere in the Society, directing special attention to many contributions made to the industry by I.E.S. committees compiling engineering data and recommended practices. "Adherence to these aims and objects", he stated, "has been a fundamental factor in the steady improvement of Society operations since its founding in 1906."

President-elect Hartenstein reiterated this pronouncement by citing contributions made by the 49 past-presidents, declaring "that men of this caliber willing to devote the necessary time to activities of this sort is a strong indication of the importance placed upon the Society's aims and ideals." Continuing to prepare technical reports for widespread distribution will always be an I.E.S. objective, he concluded.

### Progress Report

In a 2-hour interest-packed dramatization of the 1954-55 Parade of Lighting Progress, E. W. Beggs utilized countless exhibits, colored slides, movie clips, sound and lighting effects, human-interest skits, several assisting speakers and a large production crew to outline advancements in this and other nations during the past year. Introducing the theme of Light and Life, conference delegates were reminded that the goods we produce, and the things we learn, see and enjoy are all dependent upon the availability of abundant, pleasant and effective lighting, and that the use of man-made light (measured in lumen-hours) has tripled during the past ten years, with lamps being brighter, more numerous and used for longer periods than ever before.

In this progress report, Mr. Beggs called upon John Gornet, Day-Brite Lighting; Merle Keck, Westinghouse, and Charles Amick, General Electric, for their comments concerning new lighting equipment, techniques and light sources. Collectively, these men discussed and illustrated such developments as the trend towards the use of industrial fixtures with a 25% upward light component, explosion-proof industrial hand and floodlights, increased use of 5-ft T-17 and 800-milliamper

rapid-start lamps, improvements in the 96-in T-12 high-output lamp, new 1000-watt R-52 and R-57 bulbs recommended for high-bay industrial plants, and several new types of recessed commercial fixtures equipped with low-brightness louvers and end panels.

Mention was also made of the development during the past year of hollow, translucent ceiling panels, with trapped air providing sound-absorption properties; a new incandescent unit having a prismatic reflector with a concave bottom and a fibre-glass covering which produces a soft exterior radiance; new design starters for use with 40-watt fluorescent lamps and lead-lag ballasts; shallower ballasts for both indoor and outdoor operation; new 2500- and 5000-watt tubular quartz infrared lamps for use on high-voltage circuit; and new lines of weatherproof heavy-duty mercury and fluorescent-mercury lamps.

Continuing the review, conference delegates were shown 1-2,000-watt fresnel rectangular spot-flood focusing units for theatrical and television use; a new 750-w T-20 lamp permitting greater flexibility in selecting mounting arrangements; details of the 400-cycle 96-in. T-12 installation at Union College (EC&M, June, '55); simpli-



**PRESIDENT ELECT** for 55-56 season is R. F. Hartenstein, general supervisor of commercial and farm sales for the Ohio Edison Company. As fiftieth president of the I.E.S., he will head a 23-man council responsible for all Society activities during the coming season.



**GOLD MEDAL AWARD**, highest honor in the lighting field, was presented at the I.E.S. Cleveland conference to J. L. Stair, for many years associated with Curtis Lighting as sales and chief engineer as well as consultant. This was 40th Medal presented since its inception in 1914.



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fied circuits for dimming fluorescent lamps; a new 300-million candlepower short-arc mercury searchlight for airport use, and a redesigned 1000-watt mercury xenon lamp now used in Navy searchlights.

These and many other exhibits related to commercial, industrial, home and exterior lighting constituted a most impressive review, impressing all present with the pace, prestige and magnitude of the entire lighting industry.

In summarizing, Mr. Beggs pointed out that "we get Prosperity out of Light, the result of good factory and office lighting; we get Abundance out of Light, the result of farm lighting improvements; and we get Fun, Information, Security, Health, Comfort and Happiness out of Light; the result of recreation and travel units, school lighting installations, military lighting units, sun-, heat- and sterilamps, photo lamps and a wide variety of residential fixtures."

#### Gold Medal and Fellowship Awards

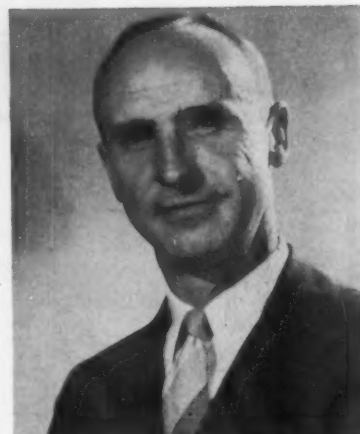
To those familiar with the achievements and contributions of J. L. Stair, the presentation of the Society's Gold Medal was recognized as a well-deserved award. For, as chief engineer and consultant for Curtis, Mr. Stair has been a leader—for over 40 years—in creating lighting environments combining eye comfort and aesthetic fitness. Also, as a pioneer in graphically presenting lighting ideas to members of the architectural profession, he has been uniquely effective in furthering appreciation of illuminating engineering among this important group.

The award, highest honor in the lighting field, was presented by H. L. Logan of the Holophane Company, chairman of the 1955 Medal Committee.

Also honored for outstanding technical competence were 12 members who were elected as Fellows, the Society's highest grade of professional status. This group included C. L. Amick, A. C. Barr, Mary E. Webber and C. E. Weitz from the General Electric Company; plus L. E. Barbrrow, National Bureau of Standards; B. S. Benson, Jr., Benjamin Electric; A. H. Clarke, Crouse-Hinds; C. L. Cottrell, Cornell University; C. D. Gibson, California Department of Education; C. A. B. Halvorson, Lighting Consultant; Carter Lewis, Union Electric, and W. A. Pennow, Westinghouse.

#### Lighting Competition

Another feature of the conference was the selection of national winners in the Society's annual MMILJ (My Most Interesting Lighting Job) Con-



**ANNUAL PROGRESS REPORT** of lighting developments was presented to conference delegates by large production crew under the direction of Eugene W. Beggs, chairman of the Society's Progress Committee, a Fellow Member of the I.E.S., and a key figure in the commercial engineering department of the Westinghouse lamp division.

test. Ten entrants, all of whom had previously won their sectional and regional competitions, were introduced by Lee E. Tayler, Detroit Edison Company, while judging of presentations (on the basis of interest, application, suitability, effect, originality and practicality) was by C. L. Crouch, I.E.S.; R. F. Hartenstein; Prof. John O. Kraehenbuehl, University of Illinois; Dr. E. F. Lowry, Sylvania Electric Products Inc., Lighting Division; and Joseph S. Schuchert, Duquesne Light.

Winner of the contest was consultant George C. Schroeder, Jr., Schroeder and Associates, for lighting the New Orleans Crippled Children's Hospital. Runner-up was architect Harold Fisher, H. H. Fisher and Associates, for lighting the Westminster Presbyterian Church in Detroit. Third prize went to H. M. White, Baltimore Gas & Electric, for the design of the system installed in Baltimore's Memorial Stadium. Fourth place was awarded to Gordon L. Dovey, Southern California Edison Company, for lighting the Paper Mate Ball Point pen factory. These winners received certificates and cash awards in amounts of \$100, \$50, \$25 and \$15, respectively.

Other finalists in this national contest included H. R. Nellis, for lighting the Knox Presbyterian Church in Toronto; David M. Damree, for lighting the Holbrook (Arizona) High School gymnasium; R. L. Garber, for back-lighting stained-glass windows in Milwaukee's Lutheran Church; Randall M. Rice, for illuminating the J. P. Lewis Airport in Beaver Falls, N. Y.;





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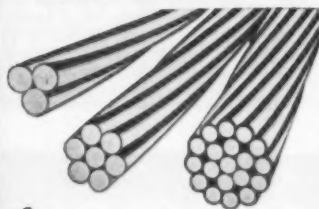
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for  
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Value**



**FIRST CANADIAN** to serve as I.E.S. president, Duncan M. Jones reviewed last year's I.E.S. activities at opening session of Technical Conference, then passed gavel over to president-elect Hartenstein. International aspect of meeting was also furthered by greetings from the Societe Francaise des Eclairagistes, extended by Prof. Georges Destriau, and a report of the C.I.E. meeting held in Zurich, presented by Dr. Ward Harrison, past president of the International Commission on Illumination.

Walter J. Lind, for lighting the G. E. district office in Vancouver, British Columbia; and the Floyd A. Covingtons (Sr. and Jr.), San Antonio and Fort Sam Houston, Texas, for art gallery lighting.

## Technical Sessions

During the first four days of the meeting, 11 technical sessions brought delegates up to date on the latest developments in light sources (six papers presented), lighting applications (eight papers), lighting research and calculations (5 papers), streetlighting (4 papers), residential lighting (4 papers and 3 demonstrations), architectural and daylighting techniques (6 papers).

Discussions on light sources covered phosphor stabilization for better lamp performance, the effect of various metal electrodes on the brightness waves in electroluminescence, the effect of bulb wall temperatures on fluorescent lamp parameters, the effect of operating variables on mercury lamp performance, the development and operation of quartz infrared lamps, and some methods for improving the strength of miniature lamp filaments.

Discussions on lighting applications covered the quality and economical aspects of parking area lighting, a study of lamp mortality and lumen depreciation of mercury lamps as a guide to lamp replacement programs, general lighting design data for using R and PAR lamps in show windows, sign-

board lighting applications and economics, relative visibility of office tasks, evaluating the comfort and cost of modern industrial lighting, using fluorescent luminaires for refrigerated areas, and combining mercury and filament lamps for comfort.

Those interested in residential lighting obtained many practical suggestions during discussions on the lighting of pictures, the use of prismatic lenses and refractors, luminous interiors, garden lighting, valances and portable lamps, recreational lighting techniques, and the combination of color and architecture in the home.

## New Officers and Directors Announced

Primarily responsible for the success of this conference (the 47th since the Society's founding in 1906) were Charles N. Laupp, Wisconsin Electric Power, chairman of the National Technical Conference Committee; Charles L. Amick, General Electric, chairman of the conference Executive Committee; and R. M. Zabel, Westinghouse, chairman of the Society's Papers Committee. Assisting these key men were large working committees handling details related to an elaborate entertaining program, decorations and displays, local and national publicity, attendance and transportation, sports, registration and reception, hotel arrangements and women's activities.

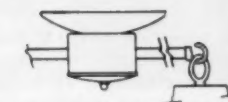
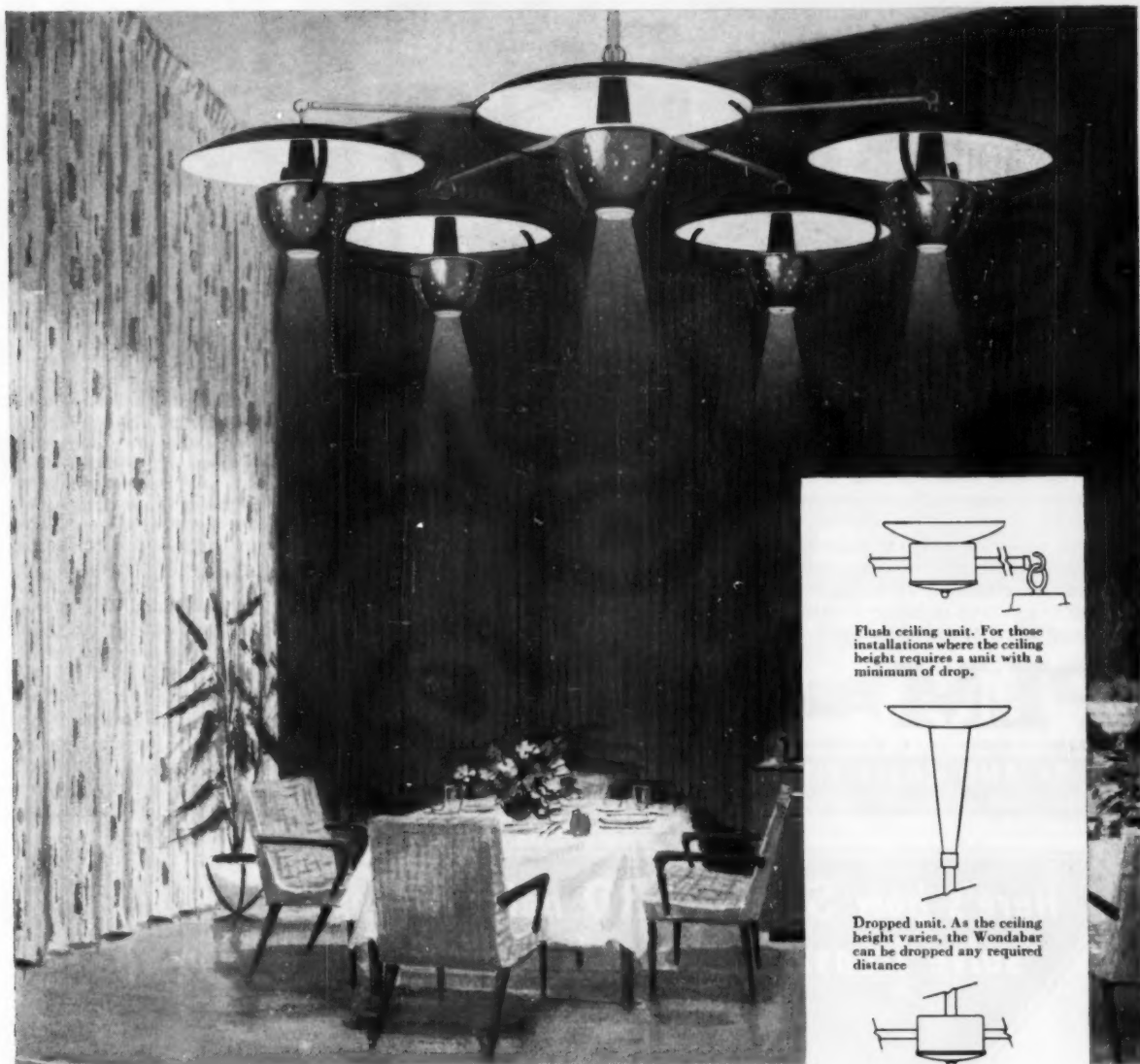
During the 1955-56 season, president Hartenstein will head a 23-man council responsible for managing all Society affairs. Assisting him will be vice presidents M. N. Waterman of Westinghouse, and Kirk M. Reid of the General Electric Company; general secretary George J. Taylor of Day-Brite Lighting, and treasurer Joseph S. Schuchert of Duquesne Light.

New directors, beginning 3-year terms, include Brooks Chassaing, Art



**JOB SUPERINTENDENT** Frank Myers is one of the team of energetic, experienced young men at the supervisory level of Wetherbee Electric Company, Oklahoma City, Oklahoma, a leading electrical contracting firm in the midwest.





Flush ceiling unit. For those installations where the ceiling height requires a unit with a minimum of drop.



Dropped unit. As the ceiling height varies, the Wondabar can be dropped any required distance.



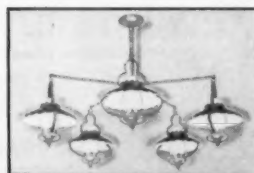
## DRAMATIC NEWS IN LIGHTING

# the Wondabar by Virden

Here it is. Decorative lighting with a custom look at *standard lighting fixture prices*. Now you can offer your customers a new concept in multi-unit lighting with the Virden Wondabar. The specially designed units come in 3, 4, or 5 light sizes—with your choice of drop.

And it's one of the most simple jobs you have ever installed. All you do is assemble and wire the Wondabar kit, install it, and attach the fixtures. Presto—there's a custom-made fixture.

For more information on the Wondabar kit, write for folder W-1. The John C. Virden Company, Dept. EC-10. 6103 Longfellow Avenue, Cleveland, Ohio.



Three applications of the Wondabar to give you an idea of how versatile this kit can be.

Decorative  
Lighting  
**VIRDEN**



whatever  
the joint  
needs

IN ONE  
PACKAGE FROM



● Why waste time worrying with many materials, from many sources, for splices and terminations? PLM Unit Package Kits simplify planning and estimating... provide *complete* materials in *one* package for correctly designed splice or termination. Supplied for rubber, synthetic, VC or paper-insulated cable—metallic and non-metallic sheathed—for ratings through 23 kv. Write for catalog.

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**WIRE AND CABLE FITTINGS AND ACCESSORIES**

Armored Cable Terminators • Splicing and Terminating Kits • Conduit Ventilators

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Complete materials in one package for splicing

- Cable in conduit to armored cable
- Non-metallic cable to armored cable
- Lead-covered cable to armored cable
- Single conductor cables to armored cable—or any combination of above.



**OUTDOOR THEATRES** are a specialty of Bob Kranch, Lancaster (Pa.) contractor, who is now completing an installation featuring small unit electric heaters to keep auto customers warm during fall evenings, when the picture leaves them cold.

Metal Co., St. Louis, and G. Franklin Dean, Hydro-Electric System, Toronto. And new regional vice presidents, beginning 2-year terms, include John G. Felton, Jr., Sylvania, Dallas; J. Dixon Mitchell, Westinghouse, Chamblee, Georgia; Joseph Thomas, Canadian G. E. Co. Ltd., Montreal; Nelson C. Warner, Westinghouse, Pittsburgh, and J. D. Whitnell, Arizona Public Service, Phoenix.

Here's how **STANDARD** helps  
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Dry-Type Load Center Transformer, 1000 KVA, with primary disconnect switch and low-voltage circuit breaker. One of a complete line of transformers developed by Standard for every class of indoor or outdoor service.



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Call your nearby Standard Transformer engineering representative. He'll work with you to determine the best solution for your unit sub-station problems and will present an efficient, economical solution. No need to choose stock designs. Standard will incorporate any special components you specify. Let us show you how you can have the best transformer for the job. Call your Standard representative today!

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THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO  
REPRESENTATIVES IN  
PRINCIPAL CITIES

#### BDSA Appoints New EED Director

John L. Cross, Westinghouse Electric Corporation executive of Sharon, Pa., was recently appointed Director of the Electrical Equipment



**E. GRIFFY, JR.**, familiarly known as "Doc" to the electrical industry in Oklahoma City, Oklahoma, is vice president and experienced, on-the-job guardian of the fortunes of Oklahoma Electrical Supply Co., a pioneer electrical contracting firm in the midwest.





**W. D. VANCE, JR.**, general manager, California Electric Company, Oakland, is happy that his firm has been designated the authorized service shop for Budgit hoists for Northern California. A complete hoist test department will supplement the existing motor repair facilities at the shop. CECO has supplied repair and construction services in Oakland for more than 30 years.

Division, Business and Defense Services Administration, U. S. Department of Commerce. Announcement was made by BDSA Administrator Charles F. Honeywell, who administered the oath of office to Mr. Cross as he was sworn in.

Volunteering his services to the Government, Mr. Cross brings to the agency a thorough and current knowledge of the electrical equipment industry. Upon completing some six months of service, he will continue to be available as a trained reservist



**CONTRACTOR CHARLES REINHARDT** of Philadelphia is helping the government Census Bureau count our growing population, for he has just completed a wiring job involving six electronic-brain Univac computers which will be used for that purpose.



**FREE!**

## Alcoa Book Gives You the Facts on the Lowest Cost Corrosion-Resistant Rigid Conduit!

Be ready with the answers when the question of corrosion-resistant conduit comes up! Come up with the right answer, the lowest cost answer: Alcoa® Aluminum Electrical Rigid Conduit.

You'll find all the facts on this lowest cost corrosion-resistant, non-magnetic rigid conduit in this book

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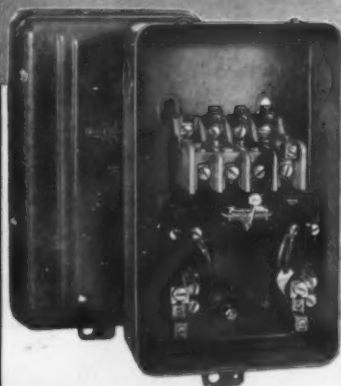
City \_\_\_\_\_ State \_\_\_\_\_

**New Alcoa Aluminum Bus Conductor makes bus systems stronger, lighter; cuts costs!** Bus systems using Alcoa's new No. 2 EC bus bar provide the best combination of strength, light weight and conductivity at a saving of up to 10%. Specify Alcoa Aluminum Bus Conductor.





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## COST

Save up to 25%. With the wide range of Furnas Electric starters to choose from, you don't have to waste money on starters too big for the job.

## CAPACITY

The many in-between sizes in the Furnas Electric line allow you to choose the control that is best suited for your particular job.

## SPACE

You can save up to 40%. By selecting the exact size starter for your requirements you get a starter that is more compact.

Write today for free 140-page Catalog 101. Furnas Electric Company, 1067 McKee Street, Batavia, Illinois.



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COMPANY**

BATAVIA, ILLINOIS

Sales Representatives in all Principal Cities



**CULTON GREENE**, owner, Agutter Electric Co., Seattle, Wash., is a staunch opponent of equipment and material quotation whittling within the electrical industry. Such practices, he believes, make it difficult for contractors to stabilize bidding procedures and work to the detriment of all concerned.

in event of any future emergency.

Following graduation from Iowa State College with a B. S. degree in Electrical Engineering, Mr. Cross joined Westinghouse in connection with its graduate student program, and was later assigned to the New York sales office. In 1941 he was transferred to the headquarters of the Transformer Division, where he has since been associated with sales work in various capacities. His present position with Westinghouse is Manager of Power Equipment Sales of the Transformer Division.



**BILL SUMMERS** of Sterling Electric, Philadelphia, does considerable design as well as installation work. His recently completed distribution revamping job for Temple University Hospital was of considerable magnitude and interest.

**W.I.W.  
66**

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NEW  
GUIDE  
POST TO  
VALUE**

**SEE PAGES  
179, 180 AND 181**

## Sound Powered TELEPHONES work in any emergency

because they  
**NEED  
NO  
CURRENT**



If everything else fails, these phones will still provide trouble-free performance over a distance of many miles. Speaking is activated solely by the sound energy of the voice while ringing is accomplished by a hand-driven magneto. For permanent installation on industrial projects or for temporary use on construction work where they can be moved as the job progresses.

### INDOOR AND OUTDOOR MODELS

In selective or common ringing and semi-selective or common talking. Cost of upkeep is negligible.

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**REPAIR AND WIRING** techniques in the marine field is the subject of a conference between Ron Irving (left) and G. Harold Kiebertz, Industrial Electric Co, Seattle, Wash. As shop superintendent, Mr. Irving is responsible for motors and equipment repair facilities. Mr. Kiebertz, a partner in the firm, handles the construction end of the business.

## NISA News

NISA's directors will hold their mid-year meeting November 5-7 in Dayton, Ohio at the Dayton Biltmore.

• • • • •

Stewart N. Clarkson, NISA's executive secretary from 1938 to 1943 was presented recently with a certificate of appreciation by Northern Institute in recognition of service on the Northeastern Board of Managers.

• • • • •

V. M. Nussbaum, partner with his



**ALASKA COMMUTER** W. R. Grasle, Jr., vice president, W. R. Grasle Co, Portland, Oregon electrical contractors, keeps busy supervising electrical projects in Nome, Fairbanks, Kodiak Island and other locations. When on home base he keeps an eye on estimating, material purchases and deliveries on local projects. A busy life for a young, energetic contractor.

# COMPARE . . . QUALITY, PRICE EASE OF INSTALLATION

And You'll Switch To The Complete



## INTERCHANGE LINE

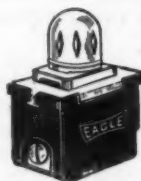
INTERCHANGEABLE WITH ALL STANDARD LINES  
OF WIRING DEVICES



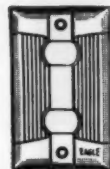
No. 801  
T-Rated Single  
Pole Switch



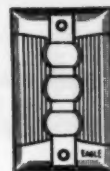
No. 902  
Power  
Receptacle



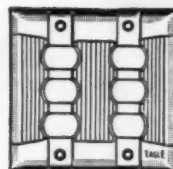
No. 905  
Pilot  
Light



No. 952  
1 Gang  
2 Device  
Wall Plate



No. 953  
1 Gang  
3 Device  
Wall Plate



No. 956  
2 Gang  
6 Device  
Wall Plate



No. 913  
Triple  
Mounting Strap

With these interchangeable devices hundreds of different combinations are possible in a very compact space. Yet ingenuity in design makes these devices as sturdy as their larger brothers in the Eagle line. They are the most advanced in design and with the modern Eagle line wall plates offer the most attractive line today.

## Check These Features

- All devices are of bakelite totally enclosed mechanisms.
- All switches and receptacles have double wipe phosphor bronze contacts.
- Large head binding screws, ample for #10 wire.
- Large radius on receptacle contacts permits easy entry of Plug Cap prongs.
- Wall plates carry the distinctive Eagle design. Correct mounting strap is packed with each wall plate in individual envelopes.
- All wiring devices are individually boxed and Listed By Underwriters' Laboratories.

Write for Catalog Showing the Complete Eagle Line and See Us At These Shows—

**NATIONAL ELECTRICAL INDUSTRIES SHOW**  
69th Regiment Armory, New York City  
October 11-14 Booth B-12

**NATIONAL ELECTRICAL EXPOSITION**  
Waldorf Astoria, New York City  
Oct. 31-Nov. 2 Booth #203, Jade Room

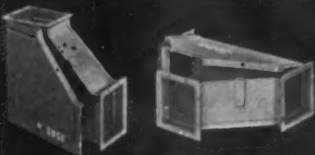


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# BOSS

## WIREWAY CUT OUT BOXES CABINETS

### QUALITY-BUILT

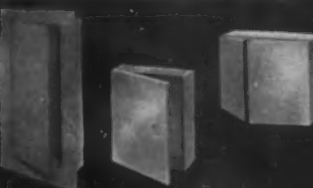
Code gauge metal, 100% UL approved construction. Firm, but easy-out knockouts. Gray baked enamel finish.

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Many years' experience, modern production methods, assure quality—reasonable prices.

### FLEXIBILITY

Choice of flanged or flangeless wireway, separate slide-lock or attached hinged cover. Full line lengths, sizes, elbows, junctions, cabinets. Adaptable to any electrical distribution installation.



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**PROJECT FOREMAN** Joe Bird of Salmon Bay Electric Co., Seattle, Wash., demonstrates pull-out feature of floor distribution panels on an 18-story apartment building. Bird finds 2-in. partitions a challenge to the ingenuity of his electrical crew.

brother, H. B., in the firm of Nussbaum Electric Co., Fort Wayne, Ind., announced his retirement June 1. He had founded the firm 42 years ago in 1912. H. B. Nussbaum has taken over his brother's interest.

Kenneth R. Lampton has joined Nussbaum Electric as a sales engineer.

The Florida members of NISA Southeastern Chapter met in Orlando, Fla., June 26 at the Orange Court Hotel. J. Howard Lott Orlando Armature Works, Inc., Florida director of the chapter, presided. Topics discussed included: sales, advertising, credits and collections, methods of costing.

J. Arthur Turner of Tampa Armature Works, Tampa, Fla. made a general appraisal of motor repair shop problems. Frank Spiegel of Brownell Distributors displayed and demonstrated several small tools of interest to shop men. Approximately 75 attended the meeting.

New Orleans Chapter met June 28 at Irwin's Restaurant in the Crescent City with president S. J. Stewart presiding. In addition to seven members, a chapter guest, new NISA member George Pappas of G&M Electric Co., New Orleans, attended. Following a business session, president Stewart read some papers that were presented at the Los Angeles Convention. It was agreed that one paper be read at each meeting of the chapter.

King Coal Chapter held its regular quarterly meeting July 21 at Cape Girardeau, Mo., at the new fireproof plant of Missouri Electric Works, Inc. Richard H. Giles was host. Following

inspection of the new plant, the group toured the Cape Girardeau water works, then adjourned for dinner after which a resume of the Los Angeles NISA Convention was given by Harold L. Chase of Giles Armature and Electric Works, Inc., Marion, Ill. and Fred Schlageter of Klein Armature Works, Centralis, Ill.

Earl E. Kuchman of Detroit Electric Motor Works, Hazel Park, Mich. is the new president of Great Lakes Chapter. Other officers include: vice-president, Clarence S. Moran, Standard Electric Motor Works; treasurer, Charles H. Howard, Howard Electric Co.; secretary, Otto G. Werner Electric Co., all Detroit firms.

From Walter J. Prise, *Queens Village, N. Y.*

## New Farm Wiring Handbook Published

New, upgraded wiring standards for America's farms are set forth in the revised edition of the "Farmstead Wiring Handbook" just off the press.

Published by the Industry Committee on Interior Wiring Design, the new 48-page manual supersedes an original edition issued in 1946. It sets down a list of minimum recommendations which in the electric industry's opinion are necessary if the farm is to be adequately wired for present and future needs.

Made necessary by the farmer's rapidly expanding use of electrical farm production equipment, the new



**CONTRACTOR BOB KEOUGH** of Philadelphia has installed over 350 residential 100-amp service entrances during the past five months. Above is a typical installation with a 3/c No. 2 cable and a panel containing a main, range, and 8 branch circuit fused takeoffs.



# ROYAL POWR- HEAVY-DUTY

**...take the current where the tools go!**

Only "POWR-KORD" offers the complete safety of MOLDED-ON attachments...every component part fully UL listed



No. 18 or 16 TYPE "SJ" RUBBER SERVICE CORD

or

ROUND MOLDED-ON ATTACHMENTS ON No. 18, 16 or 14 TYPE "S" RUBBER CORD

Have you had a sample of ROYAL-LAG time-delay PLUG FUSES?

Write for a sample and literature



**FIELD HUDDLE** of four electrical men check installation problems and progress on new Portland, Oregon, Woodrow Wilson High School. Lift-slab construction on project is new experience for (L to R) M. W. Lindsay, general inspector and C. Moore, chief electrician, Portland School District No. 1; Charles Foster, general superintendent, and E. L. Kellas, job foreman, Jaggar-Sroufe Co; Portland, project electrical contractor.

edition is a sequel to the committee's "Residential Wiring Handbook" published last year. It recommends and suggests such things as sizes of wire, number and location of outlets to help the farmer improve the efficiency, convenience and adequacy of his electric service.

Some of the handbook's changes and additions:

Service entrance panels now in most cases should be 200 amps or larger, and service entrance conductors should be no smaller than No. 2 copper or No. 0 aluminum.

All branch circuits in farm buildings are now recommended to be 20 amps.

For the first time a minimum wire size (No. 12) is recommended for branch circuits.

Wiring for such new farming wrinkles as milking pits, automatic



**REVAMPING ELECTRICAL SYSTEM** of Lancaster County water works and pumping station is one of the current jobs being handled by the Lancaster Electric Company through their electrical engineer Bill Wittick.

# -KORD EXTENSIONS



- **MOLDED-ON CAPS AND CONNECTORS**
- **FOR PORTABLE TOOLS (indoor and outdoor), LIGHTING, TEMPORARY INSTALLATIONS, MACHINES, etc.**
- **LENGTHS FROM 10 to 100 FEET**

Ask your ROYAL wholesaler for the "POWR-KORDS" that fit your requirements, and

**USE THEM ON EVERY JOB!**

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WIRING DEVICES • CARTRIDGE FUSES  
ROYAL "Crystal" and ROYAL-LAG PLUG FUSES

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**WILEY Offers:**  
**STARTER TYPE,**  
**RAPID START**  
**AND**  
**SLIMLINE**  
**LIGHTING FIXTURES**  
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## WILEY PIONEERED

Since the inception of fluorescent lighting, Wiley has been producing fixtures to one standard only—the high-quality obtainable.

## WILEY DESIGNED

Wiley lighting engineers design fixtures that are simple, clean-lined to fit any architectural plan of lighting; that are economical, easy to install and maintain.

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**PAUL HAINES**, president of Standard Electric Service in Reading, Pa., keeps up on new methods and products constantly, then reviews this knowledge periodically by scheduling informal refresher courses with his shop foremen. This permits president Haines to get to know his men personally, and it also acquaints his men with progressive ideas being developed or practiced by other organizations in the same line of endeavor.

feeders, silo unloaders, hotbeds and heat lamps over drinking and feeding areas are discussed for the first time.

Just how much greater use the farmer is making of electric power is shown in these facts: In 1930, says the handbook, a 3-wire, 60-amp electrical connection was considered adequate to service most farms. By the end of World War II, 60 to 100 amps or more were needed. Today, an upsurge in the development and purchase of new equipment, particularly that operating on 230 volts, is putting a still greater strain on most farms' wiring. Thus, some farmers are finding even 200-amp service to be inadequate.

The handbook is divided into three sections: interior wiring design, outdoor electrical distribution, and a series



**BOB LORENZ**, with contractor L. H. Ruppert in the Lancaster (Pa.) area since 1939, stresses importance of future capacity, proving his arguments by case histories of climbing current demands to satisfy requirements of air conditioning, electric heating and host of new high-wattage appliances.

***YOU* asked**  
***for them . . .***

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**ED WALSH**, electrical engineer for Shelly Electric of Philadelphia, is presently experiencing a repetition of similar work orders pertaining to dc-ac changeovers with primary power coming in at 13-kv.

of tables which show wire sizes needed to carry various electrical loads. All are explained in easy-to-understand text and diagrams. The interior wiring section covers practically every farm electrical application, from those in dairy and poultry structures to barnyard lighting and water systems. The exterior wiring section contains some all-new chapters on three-phase service, isolated motors, emergency service and underground services and feeders.

The manual is designed for use by agricultural colleges, electric power suppliers, architects, engineers, builders, electrical contractors, and lending institutions as well as the farmer.

It was developed by experts from the Wiring Design Committee's 12 sponsoring and endorsing organizations.



**THREE 13-KV TRANSFORMERS** related to a large dc-ac changeover were hoisted through an upper window and positioned adjacent to related switchgear, thereby proving again that no job is too small or too large for Philadelphia contractor Bob Nagel (right, facing camera). Units replaced outmoded steam generator, cut equipment space requirements by 75%, also effected savings in power bills.

# HIGH VOLTAGE TESTING with **HYPOTS**



**A.C. HYPOT  
MODEL 557**

has continuously variable range of 0-30,000 volts; capacity of 5 KVA.

Standard A.C. and D.C. Hypots are available for prompt delivery in most voltage ratings and capacities. Custom units to meet unusual requirements are our specialty.

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**D.C. HYPOT  
MODEL 437**

has continuously variable range of 0-15/30/45,000 volts; capacity of 112.5 VA.



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## VAP-OIL-TITE CONNECTORS

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The Original and Dependable  
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**PREVENTS COSTLY SHORTS  
and DOWNTIME**

The time-proven Simplet Vap-Oil-Tite principle, using a split ring and threaded grounding bushing, insures a permanently safe connection, positively sealed against vapor, oil, water or dust. Compression nut squeezes the grooved split ring,

makes it grip the conduit with tremendous pressure, while multiple points of contact between the ring and inside of the connector body provide a perfect seal. Corrosion resistant zinc or aluminum. Write for new bulletin and prices.



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*Cordomatic* "600"



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WALL AND CEILING MOUNTING  
**DROP LIGHT REEL**

LIGHT WHEN YOU  
WANT IT . . .  
WHERE YOU WANT IT

- ★ A rugged and dependable piece of equipment—gives you light where you want it—when you want it.
- ★ Unconditionally guaranteed for one year!
- ★ No installation costs. Just hang up, plug in!
- ★ Foolproof Recoil mechanism . . . locks at any desired length!
- ★ U/L Approved #18-2 Neoprene, Kink-proof cord! Oil resistant.
- ★ New "Stubby" Handle! 100% Neoprene.
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Available through your local jobber.



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**CONTRACTOR JOHN PFENNINGER** of Lancaster, Pa., now in his 50th year of electrical service, is one of the pioneers of the Electrical Association of Lancaster, and is also a strong advocate for boosting service entrance requirements in his territory.

Sponsors include American Home Lighting Institute, Inc., Edison Electric Institute, International Association of Electrical Inspectors, National Association of Electrical Distributors, National Association of Home Builders, National Electrical Contractors Association, National Electrical Manufacturers Association, and National Rural Electric Cooperative Association. Endorsing organizations are American Institute of Electrical Engineers, American Society of Agricultural Engineers, Illuminating Engineering Society, and Inter-Industry Farm Electric Utilization Council.

The Committee has authorized Edison Electric Institute to publish the handbook. For copies write: Industry Committee on Interior Wiring Design, Room 2650, 420 Lexington Avenue, New York 17, N. Y. or contact the headquarters office of any sponsoring organization. Single copies are 50¢; quantity prices will be given on request.



**FATHER AND SON TEAM** directs operations of the A. S. Reynolds Electric Co., Brooklyn, N. Y. contractors. Sidney Reynolds provides the engineering and business know-how of 51 years in electrical contracting while his son, Alan, is the estimator and job administrator. Industrial modernization plays a major role in the activities of this aggressive firm.

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**DRIVE STRAIGHT**

THIEL Proves the Need of a **STURDY—STRONG STAPLE**. Drives Straight—Will not Bend under any Hard Hitting Punishment. All Cable Jobs **MUST** have the Sturdiest of Staples. THIEL has the **Newest Improvement** in these products—THIEL "Easy-Drive"—"Nail-It"—"Easy On" Straps. Sold by reputable Electrical Wholesale Dealers. Send for free samples.

1100 Small (2) Wire Thiel Staples in for N.E.C. #12-14  
1125 Large (3) Wire Thiel Staples in for N.E.C. #14-12-10

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BAND SAW**



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**CUTS 8" ROUND, 16" FLAT STOCK**

Cuts pipe and conduit faster, cleaner than other methods.

You'll do better work *easier* with the Kalamazoo Model 8C. And, it's built to give you years of dependable service.

Write for details today.

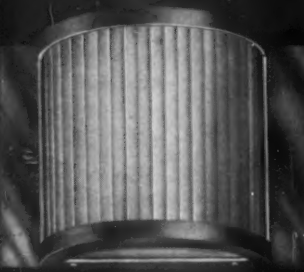
**MACHINE TOOL DIVISION**

*Kalamazoo* | **TANK & SILO CO.**

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design  
by  
mcPhilben



An Exterior Wall Bracket—4-50

Here's durability and  
performance... in a  
distinctive modern design

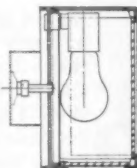
Striking in its simplicity...  
designed for long-lasting, all-  
weather protection... maxi-  
mum efficiency, wherever  
lighting fixtures take a beating.

IT'S MADE OF heavy die-cast aluminum  
throughout... satin-finished... anod-  
ized for protection against sun, rain,  
dampness.

THE UNIT INCLUDES a medium base twin  
porcelain lamp holder for one 150-Watt  
inside-frosted lamp and Flutex curved  
glass diffusers. The assembly is simple  
... a hinged door frame secured to a  
back plate with a captive held screw.

APPLICATIONS COVER... schools, hos-  
pitals, libraries, railway and bus stations,  
factories, public and office buildings...  
all institutions!

FOR OTHER WALL  
BRACKETS in ex-  
terior line, write  
for data on...  
the "4 line". Di-  
MENSIONS—(4-50)  
8" high, 11" wide,  
with a 4 3/4" pro-  
jection from the  
wall.



1333 Willoughby Avenue, Brooklyn 37, N. Y.

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mcPhilben  
Lighting  
SPECIFY

Representatives in major cities  
Stocked By Electrical Wholesalers

## GE Service Shops Up Price 10%

General Electric Company has an-  
nounced a ten percent price increase,  
effective now, for the rewinding and  
reconditioning of all motors up to 500  
horsepower.

According to Howard F. McCul-  
lough, general manager of the com-  
pany's Service Shops department, the  
boost was necessary because of an in-  
crease in copper and other material  
costs as well as operating overhead.

GE Service Shops are maintained  
in all parts of the country for the  
repair of industrial electrical ap-  
paratus.

## Rewiring Campaign Launched in Washington

An all-out campaign, keyed to the  
theme "Time to Rewire", will be  
launched by the Electric Institute of  
Washington, D. C., during October  
and November in an effort to encour-  
age home rewiring. The \$100,000 pro-  
gram, developed on a local level, is  
aimed to increase sales of electric  
dryers and ranges and make the public  
more conscious of the need for rewir-  
ing their homes.

Washington's electric appliance  
dealers, distributors, contractors, de-  
partment stores, banks and power  
company are uniting in the campaign.  
All conventional media will be used  
plus merchandising, publicity, direct  
mail and sales incentive plans.

The kick-off will begin with a full-  
page ad headlined "A Frank State-  
ment About Washington's Half-Wired  
Homes". Stress will be laid on the fact  
that today most homes are wired for  
lighting but do not have the wiring  
capacity to offer the homeowner the  
advantages of electric appliances. It  
will be pointed out that rewiring can  
be financed on the same basis as any  
other commodity.

The city commissioners have pro-  
claimed October "Adequate Wiring  
Month". The Electric Institute will  
partially pay for all dealer ads on elec-  
tric dryers and ranges during the two-  
month campaign, provided the ads  
carry the "Time to Re-Wire" mes-  
sage. Over 80 full pages of co-opera-  
tive newspaper advertising will be  
carried during the ten weeks and over  
300,000 two-color booklets will be  
mailed out by the city's banks to advise  
customers of the need for rewiring  
and the easy payment plan on which  
it can be purchased.

Public service announcements on  
radio and TV, obtained at no cost to  
the Institute, will tell Washingtonians  
that it is dangerous to overload wires



Spells quality...

**NO-KLIK®**  
QUIET SWITCHES

No. 3401 Bakelite —  
A.C. Only—Silver Con-  
tacts. Quiet Operation  
Without Mercury or  
Other Fluids. Not Down  
Rated. Lifetime Per-  
formance. I Rated (T  
rating for A.C. Switch-  
es). Operates in any  
position for both in-  
candescent (Non-induc-  
tive) and Fluorescent  
(inductive) lamp loads.  
Back or side wiring;  
strip gage. Approved  
for control of Fluores-  
cent Lamps on A-C cir-  
cuits of 277 Volts and  
less, and for motor  
loads up to 277 Volts  
at 80% of current rat-  
ing of the switch. To-  
tally enclosed mecha-  
nism with large head  
No. 8 binding screws.  
Takes any wire size up  
to No. 10. 15 AMPS.—  
120 to 277V., A-C only.

Rear View  
#3401 (Show-  
ing Back Wir-  
ing and Strip  
Gage)

No. 3421 20 AMP.  
SWITCH. Identified by  
Red Moulded Cover. Ap-  
proved for control of  
Fluorescent Lamps on  
A-C circuits of 277 Volts  
and less and for mo-  
tor loads up to 277  
Volts at 80% of cur-  
rent rating of the  
switch. 20 AMPS.—120  
to 277V., A-C only.

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**CIRCLE F MFG CO.**  
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### in kurt versen's

# NEW Radix!

**This newest fixture will sell!  
Its features will please customers  
and increase your sales.**

- no visible trim on ceiling — a perfectly smooth ceiling, without special plastering or handling.
- practically invisible light source — dramatic lighting effects, at maximum efficiency.
- baffled down-light or adjustable beam models available for widest applications.
- top or bottom servicing — standard on all units, with maximum ease of replacing lamps.
- all electrical work at one time — cuts installation costs in half, because of kurt versen cost-reducing detachable yoke construction and no-frame\* installation.

**kurt versen fixtures look better,  
work better, last longer.  
Write for master catalog.**

**kurt versen company**  
englewood, new jersey 22  
contemporary lighting  
creatively engineered

\*U.S. Patent 2,456,903; 2,614,785; other pats. pend.



**ELL RACK** in the large, modern headquarters building of Burton Bros. Electric Company, Ft. Worth, Texas, is one of many shop made devices which add speed and efficiency to everyday operations. The idea of this rack, and of many of the other shop devices, was conceived by Bob Burton, shown above, who runs the company with his brother Jack. The rack is made of 2 by 4's bolted together. Lengths of pipe are run between holes in the upright members of the rack, forming four levels for storing elbows, with varying spacing between the parallel pipes which make up the rack. As can be seen, larger ells are stored on the lower pipes; shorter ells, on the upper pipes. This rack provides easy storing of ells, affords quick selection of the various sizes of ells and is generally more handy than any other type of rack would be.

and that rewiring is a safety "must". Streetcars and buses will carry the same message on posters as a public service.

A contest to spur electric appliance sales will offer \$3300 in cash prizes to dealers and salesmen during the campaign. In addition, there will be paid radio and TV skits, banners, truck signs and point-of-sales material provided to all dealers and banks.

## Ling Electric, Dallas, Expands in Southwest

In a progress report to executives and stockholders, James J. Ling, president of Ling Electric, Inc., Dallas, Texas, outlined plans for expansion. These plans included establishment of offices in four states: Topeka, Kansas; San Diego, Calif.; Dover, Delaware; and New Orleans, La.

Work is now underway on two Oklahoma branch offices, at Altus and Ardmore, and another in Lawrence, Kansas. Offices in Los Angeles, Calif., Washington, D. C., and Denver, Colo., are also in prospect.

Ling added that the Dallas-based firm would be the first electrical contracting firm in the Southwest to establish itself as a national concern.

## Zenith AUTOMATIC CONTROLS

**ARE ENGINEERED TO  
GIVE YOU GREATER ACCURACY!**

Rely on field-proved ZENITH Controls for trouble-free, maintenance-free operation... long-lasting performance and accuracy.

The ZENITH line includes: Magnetic Contactors; Remote Control Switches;

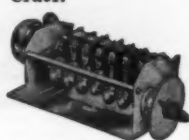


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It PAYS to use*

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CARBON  
BRUSHES

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INCREASE BRUSH LIFE  
CUT MOTOR DOWN TIME  
SLASH MOTOR MAINTENANCE**



Motors and generators are a costly investment... they deserve **HELWIG CARBON BRUSHES**. **HELWIG CARBON BRUSHES** cut down vibration and give better contact — eliminate uneven wear and reduce circulating current.

Brushes are manufactured to size — need not be cut down to fit commutator. It **PAYS** to protect your electrical equipment with **HELWIG CARBON BRUSHES**.

**HELWIG** CARBON PRODUCTS   
2546 N. 30th St.  
Milwaukee 10, Wisconsin



## NEMA Discusses Wire and Cable

The latest developments in the wire and cable industry were discussed at the September 26-28 meeting of the National Electrical Manufacturers Association's Wire and Cable Section before eighty-five of the industry's executives at the Skytop Lodge, Skytop, Pa.

William A. Meissner, Deputy Director, Copper Division, Department of Commerce, spoke on the copper situation and said "It is increasingly apparent that the entire copper situation can be summed up in one word—price. There is sufficient copper physically available to meet requirements, but there is not sufficient low price copper to meet them.

"This administration does not favor price controls, nor do we believe that you do. We believe in free enterprise in the scheme of things, and the fact that your competitor is able to obtain more 43-cent copper than you is a matter over which we have no control.

"We have made an attempt to work with NEMA on all problems concerning the wire mill industry, and at present are working out a program in regard to surplus disposals."

Ray G. Boyd of Kaiser Aluminum & Chemical Sales, Inc., discussed the aluminum supply situation. The suitability of aluminum for use as magnet wire, as building wire was explored.

Major changes in the new Bureau of Mines Schedule 2-F entitled, "Electric Motor-Driven Mining Equipment Junction Boxes", were reported by E. G. Sturdevant, Chief engineer, United States Rubber Co. He said the changes that interested the wire and cable industry are "that it permits the use of a ground trip relay as an alternate to a grounding conductor in a cable for keeping the frames of underground equipment at ground potential, and that it provides for the procedure to govern the use of unapproved or experimental equipment in gassy mines for a six-months period. The trial period may be extended to one year by approval of the Bureau of Mines," he said.

In discussing the trend towards super high-tension cables, Robert J. Wiseman of the Okonite Company said, "The electric power supply forecasts show that by 1965 the generating capacity will be double the present amount, or a total capacity of about 200,000,000 kw. A large portion of this increase will be in the generating units of 100,000 kw and over. In many cases, it will go as high as 200,000 to 350,000 kw. These large amounts of power will be transmitted most



New frame and hydraulic unit are quickly assembled with forming shoes, rollers and accessories for handling a variety of work. YOU CAN ALSO CONVERT YOUR OLD TAL BENDER!

**"I CAN BEND YOUR PIPE AND TUBING IN ONE SHOT WITH ONE TOOL"**

**THE NEW TAL "ONE-SHOT" BENDER BENDS EVERY TYPE of PIPE and TUBING**

**IT'S EASY**—Even this girl could quickly bend perfect, identical, wrinkle-free bends and offsets to any angles with the TAL "ONE-SHOT" Hydraulic Bender.

**IT'S ECONOMICAL**—Now you need only one tool to make 90° and 180° bends in pipe, rigid conduit, thin-wall conduit, and hard and soft copper metal tubing.

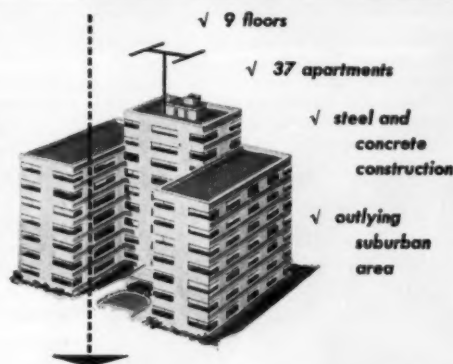
**IT'S FAST**—Even 180° bends are completed in just one setting—without shifting the pipe or conduit. Bend indicator insures accuracy. It takes less than one minute to make each bend. Learn how you can handle more jobs—and earn more money!

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UTICA DROP FORGE & TOOL CORP.  
UTICA 4, N. Y.

In Canada: Adlam Tool & Supply Co., Ltd., Montreal

efficiently by voltages of 138 kv to as high as 345 kv and possibly 400 kv.

"The electric cable industry is now studying methods for improving the materials used for insulation. It is reviewing the manufacturing methods employed and is investigating the thermal and physical properties of the soil surrounding the cables to learn how to get the highest current-carrying capacity out of the power circuit."

G. J. Crowdes of Simplex Wire and Cable Co. said, "Rubber-insulated cables, especially in the 2 to 35 kv range, are being used more and more as the electrical industry expands. It is anticipated that the output for Class I systems in the United States will approximate 900 billion kw hrs in 1963. Such a load will need efficient design of the electrical, mechanical and thermal characteristics of rubber-insulated power cable in both industrial and utility circuits."

Mr. Crowdes provided "comparative data between the newer synthetic rubber butyl and both natural and oil-base insulation, the quality criterion of the past." He emphasized the relative performance of these materials in various environments and under various deteriorating situations. He said that tests and field experience indicate that butyl and oil-base rubber differ in their properties. Butyl insulation has greater resistance to heat and aging, deterioration from moisture, ozone and corona. The dielectric strength of the two materials seems to be reasonably close. The dielectric constant and power factor are lower for the butyl and its resistivity is higher. These properties permit butyl insulated cable to operate at higher temperatures for normal emergency and short-circuit loading.

Proposed changes in the 1956 National Electrical Code as they effect wire and cable were discussed by C. W. Zimmerer, associate electrical engineer, Underwriters' Laboratories, Inc., New York. He said proposed changes will include a complete rearrangement of the sections relating to wire and cable for the purpose of making this data more useful. In addition, the following items are among the important proposals recommended by the Code-Making Panel No. 6:

1. A section on temporary wiring.
2. A heat-resistant, rubber-insulated wire (Type RH-90) for use at 90C.
3. Establish maximum temperatures for copper and aluminum conductors.
4. Tables for the current-carrying capacity of insulated aluminum conductors.

A proposal for recognition of a moisture and heat-resistant thermoplastic insulated wire (Type THW) for use at 75C is under consideration.

## Tested aids for planning - designing safe, economical industrial electrical systems



A wealth of practical, proven data... presented by a staff of General Electric specialists... covering all major phases of power system design

"Authoritative, complete, and exciting"—FACTORY

Better operation and service—more safety—greater economy—flexibility—easier upkeep and expansion—these are advantages this book can give to industrial power distribution systems. Use it for commercial and institutional buildings as well as industrial plants. It gives you engineering methods and data that pay out in every phase of planning a new installation or modernizing or expanding an old one.

## JUST OUT! INDUSTRIAL POWER SYSTEMS HANDBOOK

Donald Beeman, Editor

Manager, Industrial Power Engineering, Industrial Engineering Section, General Electric Company, Schenectady, New York

971 pages, 6x9, over 500 illus., \$12.50

Here's practical help in planning, designing, and modernizing industrial power systems. Combining descriptive and handbook features, this aid to efficient, trouble-free performance covers such areas as short circuit protection, methods of voltage regulation, allowable system voltage variations—and costs of various power systems.

### CONTENTS

1. Short-circuit-current Calculating Procedures
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3. Selection of A-C Short-circuit Protective Devices and Circuit Equipment
4. Voltages—Standard Ratings, Allowable Variations, Reduction of Variations, Calculation of Drops
5. System Overvoltages—Causes and Protective Measures
6. System Grounding
7. Equipment Grounding
8. Power-factor Improvement
9. System Overcurrent Protection
10. Selection of System Voltages
11. Load-center Power Systems and Circuit Arrangements
12. Secondary Distribution Systems
13. Primary Distribution Systems
14. Power Systems for Commercial Buildings
15. Modernization and Expansion of Existing Power Systems
16. Steam and Power Generation
17. Load- and Cost-Estimating Data

Descriptions, practices, data, worked-out examples fill the book—span such subjects as methods for protection against system overvoltages due to lightning, switching surges, and economic aspects—everything from methods of generating by-product power to cost load and cost estimating data.

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## Plant Conference To Be In Philadelphia, January 23-26

Fifty sessions on 26 aspects of factory upkeep will highlight the seventh annual Plant Maintenance & Engineering Conference to be conducted in Philadelphia in January. The conference, the largest annual industrial gathering of its kind, will be held concurrently with the Plant Maintenance & Engineering Show at Convention Hall, January 23 to 26. About 2,500 engineers are expected to attend the conference and some 20,000 industrial executives are expected at the show. L. C. Morrow, consulting editor of "Factory Management and Maintenance", will serve as general chairman of the conference.

At the show, about 400 companies are expected to exhibit some 5,000 different products and services in 278 basic types. The 1956 program will be arranged in three groups. There will be two general conferences which all registrants attend; eight concurrent sectional conferences which will be attended by those interested; and 16 concurrent, informal round table discussions of special problems. Each of the eight sectional conferences and the round tables will be repeated during a second evening.

Six industries will receive special attention at the round tables: air transport, chemical, iron foundry, petroleum refining, paper mill and paper products and textiles. Maintenance problems in these industries will be discussed.

The conference will start with a general session on "How We Look At Preventive Maintenance". The second general conference will be a panel discussion on "Maintenance Controls", including planning and scheduling for effective cost control, inspection procedures for quality control, and control-minded maintenance personnel. The sectional conferences will consider: "getting maintenance people to work as a team", "yardsticks for measuring the effectiveness of maintenance", "sanitary standards and how to meet them", "equipment replacement policies", "using the services of independent contractors", "maintenance in plants on 24-hour operation" and "design and operation of maintenance shops".

Topics of discussion for the round table sessions are: "maintenance of yard structures and yard equipment", "how punched cards facilitate maintenance", "getting the most out of electrical equipment", "lubrication practices", "maintenance of machine tools", "report writing", "forms, records and reports".

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The Barth Cable Puller attaches directly to conduit—no strain on junction boxes. Light weight only 70 pounds. Operates on 120 volts. Rugged, quick to set up, easy to move from job to job.

Complete details and prices—MAIL THIS COUPON TODAY!



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12680 Brookpark Road, Cleveland 30, Ohio  
Please send complete Cable Puller data folder and prices.

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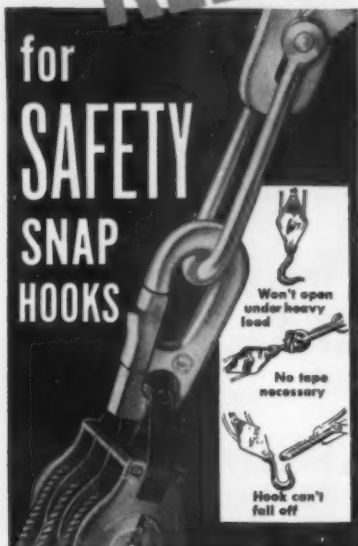
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455-SP

Here's strength, safety on heavy loads—for blocks, tackles and hoists. Klein Safety Snap Hooks are time savers, too, eliminating the necessity of taping or wiring the throat. Made of drop forged steel—carry a working load of 8,000 pounds with adequate safety factor. Snap on easily with one hand—may be used on any conventional steel block 6 inches or smaller, or on chain hoists or snatch blocks. Four types regularly available. Specify 455-SH-3 Snap for use with 1½-ton hoists... No. 455-SP for double chain hoists and for attachment at housing. Klein can also supply safety snap hooks for lighter loads.

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## New Books

### Westinghouse Home Wiring Handbook

The latest revision to this handbook includes all changes required for conformity to the 1953 National Electrical Code. Also introduced is the concept of three degrees of electrical living and data which makes possible the quick establishment of load, circuit, and service requirements. This method of planning the residential system is of particular value where the exact electrical equipment to be used is not known at the time of construction. By A. Carl Bredahl, Consumer Service Dept., Westinghouse Electric Appliance Div., Mansfield, Ohio. 142 pp., \$1.00.

### Lineman's Handbook

This third edition of the standard manual for line constructors features such new material as tower line erection, live line maintenance, rural lines, gear signals for line work, and latest developments in work techniques. Subject matter ranges from such basic data as electrical formulas and principles through detailed installation and maintenance procedures and system design. By E. B. Kurtz. McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. \$10.00.

### Electro-Technology

A compact reference source which presents and explains theorems that are the basis of electrical engineering. The second part of the book is a complete guide to the handling of circuit problems. By M. G. Say. Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. 167 pages. \$6.00.

### Connecting and Testing Direct-Current Machines

The first part of this third edition deals with reconnecting dc motors and generators for a change of voltage or speed or both; part two covers methods of locating and remedying faults. New material has been added on new high temperature insulations, preventative maintenance methods, and use of high-frequency, high voltage testing equipment. By F. A. Annett and A. C. Roe. McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. 313 pages, \$5.00.

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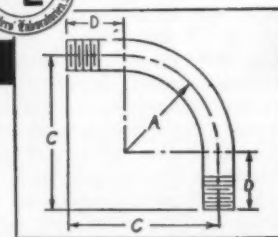
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## DATES AHEAD

**International Association of Electrical Inspectors**—Eastern Section, Mark Twain Hotel, Elmira, N. Y., Oct. 10-12; Canadian Section, King Edward Hotel, Toronto, Ontario, Canada, Oct. 21-23.

**National Electrical Industries Show**—69th Regiment Armory, New York City, October 11-14.

**N. J. Council of Electrical Leagues**—19th convention, Atlantic City, N. J., October 14-15.

**National Safety Council**—43rd National Safety Congress & Exposition, Conrad Hilton Hotel, Chicago, Ill., October 17-21.

**Southeastern Electric Exchange**—General Sales Conference, Biltmore Hotel, Atlanta, Ga., October 27-29.

**National Electrical Contractors Association**—Annual convention Waldorf-Astoria, New York City, October 31-November 4.

**Fifth Industrial Electric Exposition**—Hotel Wm. Penn, Pittsburgh, Pa., November 1-3.

**National Electrical Manufacturers Assn.**—Annual meeting Traymore Hotel, Atlantic City, N. J., November 14-18.

**Industrial Heating Equipment Association, Inc.**—Annual meeting, LaSalle Hotel, Chicago, Ill., January 23-24.

**Plant Maintenance & Engineering Show and Conference**—Convention Hall, Philadelphia, Pa., January 23-26.

**National Rural Electric Cooperative Assn.**—St. Louis, Mo., January 23-26, 1956.

**American Institute of Electrical Engineers**—Winter general meeting, Hotel Statler, New York, N. Y., January 30-February 3.

**Independent Electrical Contractors Assn., Inc.**—Annual dinner and dance, Hotel Biltmore, New York, N. Y., February 11.

**National Adequate Wiring Conference**—La Salle Hotel, Chicago, Ill., February 23-24.

**National Electric Sign Association**—Annual convention and exhibit, Jefferson Hotel, St. Louis, Mo., February 26-29.

**National Electrical Manufacturers Assn.**—Edgewater Beach Hotel, Chicago, Ill., March 12-16.

**National Industrial Service Association, Inc.**—Annual convention Bellevue Stratford Hotel, Philadelphia, Pa., May 13-17.

**National Fire Protection Association**—60th Anniversary meeting, Hotel Statler, Boston, Mass., June 4-8.

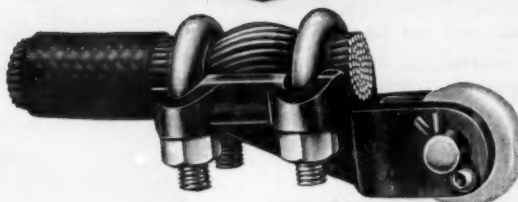
**National Association of Electrical Distributors**—48th annual convention, Ambassador-Chelsea Hotels, Atlantic City, N. J., Week of June 10.

**New York State Association of Electrical Contractors and Dealers, Inc.**—Annual convention, Saranac Inn, Saranac, N. Y., June 24-29.

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## Among the Manufacturers

### Headquarters Announcements

Westinghouse Electric Corp., Pittsburgh, Pa.—Gwilym A. Price, chairman of the board, will also continue as president; Mark W. Cresap, Jr., executive vice president and deputy chief executive officer; Latham E. Osborne, vice chairman of the board; John K. Hodnette will be a member of the board and vice president-general manager, product groups; A. C. Monteith, vice president, apparatus division; and Dr. John R. Hutcheson, vice president engineering and research.

B. A. Wesche Electric Co., Cincinnati, Ohio—Samuel Noodleman, vice president in charge of engineering, sales and production.

T. J. Cope, Inc., Philadelphia, Pa.—James G. Thomas, sales manager. Keystone Manufacturing Co., Center Line, Mich.—Chester E. Cook, general sales manager.

Anderson Brass Works, Inc., Birmingham, Ala.—C. E. Bitzer, general sales manager.

Electric Controller & Mfg. Co., Cleveland, Ohio—J. R. Woodruff, assistant sales manager.

General Dynamics Corp., Electro Dynamic Div., Bayonne, N. J.—John F. Thurston, general manager.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—J. V. McGuire, manager of the switchgear department.

Toledo Pipe Threading Machine Co., Toledo, Ohio—C. E. Hartsing, manager of field sales.

Wheeler Reflector Co., Boston, Mass.—Frank A. Sullivan, sales manager.

Dixie Electrical Mfg. Co., Birmingham, Ala.—M. L. Ruggieri, president; Clarence Lloyd, vice president in charge of sales; C. H. Moses, Jr., secretary-treasurer. This newly organized firm will produce pole line hardware, street lighting brackets, mast arms and outlet boxes.

Clark Controller Co., Cleveland, Ohio—David C. Wycoff, manager of product adaptation department.

Louis Allis Co., Milwaukee, Wis.—E. P. Allis, chairman of the board; John W. Allis, president.

Bryant Division of Carrier Corp., Indianapolis, Ind.—Philip C. Kosch, sales manager.

### Regional Appointments

#### NEW ENGLAND

Garden City Plating & Mfg. Co.: Jackson-Seeley Co., representatives



## —SEARCHLIGHT SECTION—

### U. S. Government

Sealed bids will be received in the office of Engineering and Construction Director, Panama Canal Company, Balboa Heights, Canal Zone, until 10:00 A.M., EST, November 15, 1955 and at that time publicly opened, for the following: Furnishing all plant, labor, materials, equipment, and services and performing all work to convert all domestic commercial, and industrial equipment on the Atlantic side of the Canal Zone from 25 to 60 cycle operation. Plans and specifications are available for examination in the office of Procurement Officer, Panama Canal Company, 21 West Street, New York 6, N. Y. A pre-bidding conference will be held in the Administration Building, Balboa Heights, Canal Zone, at 8:00 A.M., October 5, 1955, to which all prospective bidders are invited to attend. Plans, specifications, and bid forms may be obtained from Procurement Officer, Panama Canal Company, 21 West Street, New York 6, N. Y., upon payment of \$50 deposit which should be in form of cash, money order, or certified check made payable to Treasurer, Panama Canal Company.

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### MIDDLE ATLANTIC

Pennsylvania Transformer Co.: Carl R. Boytano, sales engineer in the New York City office.

Multi-Amp Corp.: William A. Sternad, N. Y.-N. J. representative.

Lightolier, Inc.: Robert Smith, representative for western Pennsylvania and the southwest corner of New York.

### SOUTH ATLANTIC

Permacel Tape Corp.: John E. Schuler, field manager of operations in N. C., S. C. and Tennessee with offices in Charlotte.

### EAST CENTRAL

Pittsburgh Reflector Co.: Paul F. Stiller, manager of sales, service and engineering for Kentucky, parts of West Virginia and Ohio, south from Columbus; offices in Newton, Ohio.

Rome Cable Corp.: T. C. Spriggs, sales representative at Chicago office.

Line Material Co.: Morriss E. Beavers and Houston E. Hastings, field engineers in south central division. Beavers will work out of Chattanooga, Hastings from Nashville, Tenn.

Acme Electric Corp.: Eldon W. Miller, sales representative for Dayton, Ohio territory.

General Electric Co.: L. R. Spicer, manager-Milwaukee sales for the Industry Control Dept.

Lightolier, Inc.: Richard Wertheim, sales representative for eastern Ohio and Youngstown and New Castle, Pa.

### WEST CENTRAL

Line Material Co.: F. J. Warren, Jr., field engineer for southwestern Louisiana with offices in Lake Charles; J. F. Chamblee, headquartered in Dallas, will be L-M field engineer for west central Texas.

Electric Controller & Mfg. Co.: O. J. Archer, district sales manager in Houston, Texas.

Lightolier, Inc.: Edwin Anderson, sales representative for eastern Texas.

### WEST

Sylvania Electric Products Inc.: L. A. Komor, northern California district engineer for lighting.

Line Material Co.: P. J. Maloney, fiber products sales engineer for California, Nevada and Arizona; offices in Los Angeles.

Rome Cable Corp.: R. D. Golly, sales representatives and engineer, Los Angeles office.

Electric Controller & Mfg. Co.: C. A. Mitchell, Jr., Pacific Coast district manager with offices in Los Angeles.

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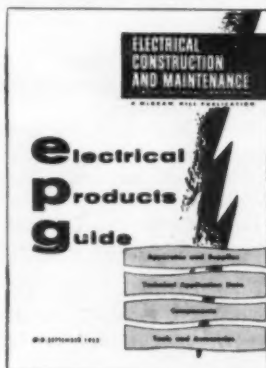
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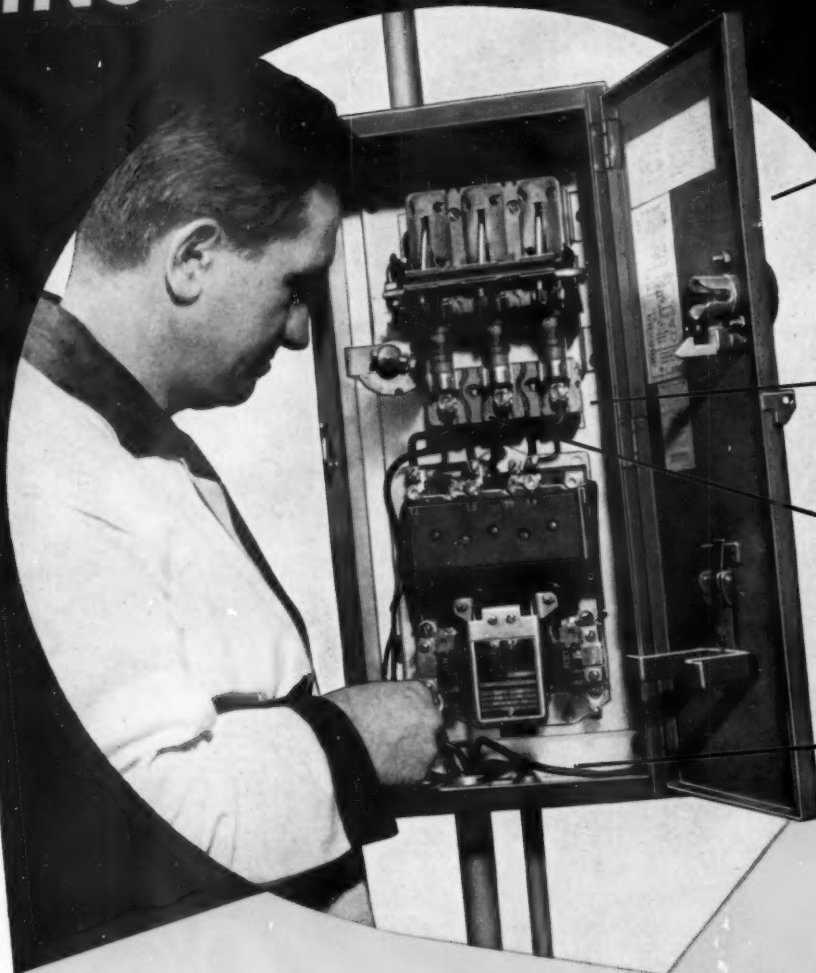
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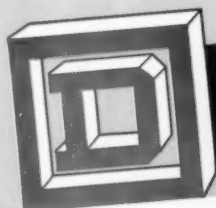
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